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JOPS and Resupply: The Connection

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The System

The Joint Chiefs of Staff (JCS) sponsored Joint Operation Planning System (JOPS) is the primary tool used by a unified command to create the current year operation plan for the defense of his area of responsibility. Although considerably more complex than this brief overview, the process begins with publication of the Joint Strategic Capabilities Plan (JSCP-FY XX) for the impending fiscal year. Orchestrated by the unified command, component planners create an automated expression of the desired deployment profile for combat and support forces in a time-phased sequencing - a Time Phased Force Deployment List (TPFDL). Trying to capture this process in one sentence does not do justice to this arduous, time consuming effort. Planners must sequence each army division, its support, and each fighter squadron plus its attendant support, a procedure that takes several months.

Following this, component logisticians use the JOPS Movement Requirements Generator (MRG) to create an automated expression of resupply transportation requirements (tons over distance) to compete for airlift and sealift in follow-on computer transportation feasibility simulations. The unified commander's objective is to submit to the JCS for approval an operation plan (OPLAN) that is logistically feasible and supportable; that is, the forces can be deployed as planned with the existing transportation assets and can be supported. Whether this is accomplished with the present system is left to the judgment of JOPS users.

Ideally, the unified commander's OPLAN should reflect near exact resupply movement requirements and the Transportation Operating Agencies' (TOA) movement schedules should reflect the planned deployment of real supplies and munitions.

If recent command post exercises (CPX) are good indicators, the airlift schedules created by the JOPS process will probably be used, at least initially, at the outset of a major conflict. Although the JCS does not allocate lift resources by approving an OPLAN, the mere existence of airlift and sealift movement schedules will necessitate their use in the absence of an alternative. The airlift schedules produced by the Military Airlift Command for Wintex/CIMEX 79 proved to be an extremely valuable management tool for unified command planners and operators to implement the simulated deployment of forces to the overseas theater. Actual unit designations and actual onload/offload locations facilitated implementation. As a result of several successful iterations of OPLAN development and simulated implementation during exercises, confidence in this system - the completed OPLAN, Time Phased Force Deployment Data (TPFDD) file and movement schedules - is very high. Most planners believe the system will be successful for the movement of forces in a crisis situation. The same is not true for the movement of supplies.

Notional Resupply Planning

The MRG was not designed as, or intended to be, a supply requisitioning tool. To create resupply movement requirements, consumption factors, expressed in pounds/man/day or tons/unit/day, are multiplied by force population densities. Factors such as prepositioned war reserve stock levels, force arrival dates, supply build-up policies, and air resupply policies, to name a few, all impact the mathematical equation. The results are tons of each class of supply from an origin to a destination. They are not amounts of individual federal stock numbered items. To schedule transportation against these requirements, the automated resupply expression must be honed to the most finite and credible extent possible. In the first days of a war the movement of critical supplies must coincide with the scheduled deployment of units; therefore, the scheduled movement of resupply should be as valid as the movement of forces. The ultimate outcome of this process, in addition to an approved OPLAN, should be an airlift and sealift movements schedule that could be implemented today, if required. It is very disquieting to realize the resupply expressed in the unified command OPLAN is notional at best. Hence, the transportation scheduled for the movement of these commodities is also notional. This is not to say that defense logistics agencies and Service supply planners are not doing the job. In fact, the right quantities and types of supplies may be prepared for deployment on a continuing basis, but movement of the real supplies is not reflected in the unified command OPLAN and the TOA movement schedules. The connection is simply not there.

Furthermore, in contrast with force planning, there is no means available today to take the automated JOPS resupply record produced by the MRG and translate it to actual supplies or munitions available for movement from depot to consumer. The JOPS planning procedures call for defense agencies responsible for supplies to produce real resupply data after JCS transmits an alert order. Given a short warning scenario, this could be too late and result in the frustration or, at best, delayed movement of critical supplies. Hence, the effect of the existing system is notional resupply planning and notional transportation planned for the movement of resupply materiel.

General William G. Moore, when he was CINCMAC, expressed considerable concern with the lack of a system to collectively produce movement demands for supplies and munitions prior to and subsequent to implementation of an OPLAN. Since then JCS has created a Joint Deployment Agency (JDA), chartered with the responsibility of coordinating the deployment of forces and supplies to the overseas theater. The JDA should strive to coordinate now, well in advance of a crisis, the movement demands of all the various defense logistic agencies, Service commodity managers and depot supply managers. In this way, one single agency, the JDA, can

orchestrate the movement of critical supplies and munitions to the overseas theater. The way to achieve this is to develop real resupply data as part of the unified command OPLAN, TPFDD, and TOA movement schedules. To the extent feasible this should be done for the first 15 to 30 days of a major OPLAN. This should result in a more accurate expression of movement requirements.

Valid Movement Requirements

The means of developing real resupply data is at the heart of the issue. There does not appear to be any need for a more detailed expression of supplies or munitions on the TPFDD record; therefore this article is not a call for the redesign of the TPFDD record. However, there is a very definite need for a near exact correlation between the TPFDD resupply record and actual supplies requiring movement. If the TPFDD record reflects 300 short tons of munitions requiring movement from Wright-Patterson AFB, Ohio, to Ramstein, Germany, there must be a degree of assurance that the munitions do exist, other than notionally on a JOPS TPFDD record, and that they are at Wright-Patterson. The way to accomplish this is to manually intervene in the JOPS process by replacing the MRG calculated supply requirements for at least the first 30 days and interject actual supply/munitions movement requirements developed by the agencies responsible for their management. These movement requirements should be created at the level where the movement requirement is known, passed through the agency responsible for the overall management of that commodity, passed to the JDA, and passed to the unified component command that will ultimately be the consumer. The component commander can assign priorities and alter dates and modes of transportation, if desired. Once the TPFDD is completed and approved, the supplies and munitions for stored items can be palletized and prepared for shipment. For fluid, dynamic, or stocks-in-motion commodities, such as the army ALOC cargo, a fixed amount of transportation from a specific location should be scheduled for the known amounts and frequencies of cargo movements. The same could be done for critical and high value items such as aircraft engines and air-to-air missiles. This system will ensure real resupply is identified for movement, credible airlift and sealift schedules are developed, and all players have the OPLAN, TPFDD and movement schedules in advance of implementation. By employing this technique the most valid supply availability information will be introduced at the level where it is managed. But the lack of JOPS qualified personnel at this level brings us to the basic cause of the problem.

More JOPS Qualified Planners Needed

The lack of positive feedback on the adequacy or accuracy of MRG developed resupply data is a major aspect of the problem of notional movements data. The TPFDD records created by the MRG can only be as accurate as the variables applied in the mathematical equation. The unified command logistic planners assume, in the absence of feedback, that computer iterations have produced credible results. But widely varying results in OPLANs of succeeding years would lead one to the logical conclusion that resupply data submitted as part of the OPLAN goes without review; that is, it remains notional. To progress beyond notional data, real resupply TPFDD records must emanate from the defense agencies responsible for the management of supplies. If one agency manages air-to-air missiles, they should create the data in JOPS automated format, providing a positive contribution to the overall planning process and removing the guesswork from resupply planning.

This sounds easy, but exposes another difficult and more pervasive problem in presupposing the necessary JOPS qualified logistic planners exist within defense logistics agencies and Service headquarters. This is the cause of the problem and goes to the very core of the issue of quality logistics data from JOPS. There are very few qualified JOPS planners worldwide, including all of the Services. When the focus is narrowed to JOPS *logistics* planners, there are even fewer qualified individuals. To implement a system of generating quality supply data for a unified command OPLAN the requisite JOPS expertise must be resident at each critical level of data development and review. The lack of adequate JOPS planners is a cogent concern which has received considerable visibility at the highest military management levels and will have a direct bearing on the effectiveness of the newly formed JCS Joint Deployment Agency.

Another facet of this same problem must be addressed. There is a very real competition between the needs of the JOPS planning community and the career needs of the individual within the system. As the needs of the system are met, the needs of the individual are denied. The JOPS process is served best with maximum retention of individuals in JOPS related planning functions and minimum turnover of personnel. Since the JOPS community is small and very specialized, individuals within the JOPS community see successive JOPS planning positions as career stagnation. Planning positions in JOPS are specialized to the point of being restrictive. Becoming expert in one of the various JOPS automated modules makes one the likely candidate for the next JOPS assignment requiring the same expertise, thus adding to a specialized career. This problem is magnified since there are too few qualified JOPS planners to select for the next assignment. The ideal solution to this problem - more qualified JOPS planners - will also ensure the necessary expertise is available within the logistics community. Ideally, qualifying more JOPS force and logistics planners will allow for the rotation of individuals in and out of JOPS positions, and minimize the over-specialization of individual careers, as well as providing the necessary expertise in key logistics positions.

Preparation Through Planning

Intensifying efforts to qualify more JOPS logistics planners will address the causitive factor in the problem of notional resupply movements data. More JOPS logistics planners will ensure the requisite expertise will exist in the future to address the issue of real resupply data in the unified commander's OPLAN. Real resupply data will thus eliminate the negative effects of this system problem and ensure valid transportation is planned - the connection will be made. As plans transition to operations in a crisis, airlift and sealift schedules will serve initially as a point of departure at a time when uncertainties will abound. Therefore, the more we do in preparing for the first 15 to 30 days of deployment, the more credible is our planned mission potential.

An Adaptation of Sequential Sampling Techniques to Reduce Repair Turnaround Time

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The Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio, is the Technology Repair Center (TRC) for the AN/AJN-17 (LN-15) Inertial Measurement Unit (IMU) used on B-52 G/H aircraft. The aircraft master computer, using heading and acceleration information from the IMU, computes the north-south and east-west components of the aircraft's velocity and present latitude and longitude position of the aircraft. This information is then supplied as an initial reference for alignment of the inertial guidance systems of the Short Range Attack Missiles (SRAMs) on board the B-52. The major error source within the IMU is the gyroscope (gyro) (two per IMU). The majority of IMU test time at the TRC is devoted to measuring various gyro parameters. One such parameter is gyro drift. Gyro drift is an error in the gyro output caused by unavoidable imperfections in the gyro. Gyro drift can be measured and compensated for so that it does not cause an error in the IMU's output. The process of measuring and inserting a bias to correct gyro drift is called "gyro biasing."

Performance Requirements

Ground alert requirements of B-52 G/H aircraft, equipped with these LN-15 Inertial Measurement Units (IMUs), result in a system design requirement that is unique to aircraft inertial navigation systems. This criteria specifies that the system must be capable of satisfactory performance without gyro rebiasing for a period of 42 days. Gyro drift, therefore, must remain within the limits of the resulting system error budget to provide the required SRAM Missile Guidance System alignment accuracy.

Gyro bias stability is evaluated by Strategic Air Command personnel who compare the most recent gyro bias values to any previous values obtained during on-aircraft calibration of gyro constants. This change must not exceed an average value of 0.00143 degrees-per-hour per day. Field calibration of gyro constants was originally required every 42 days. This interval was later increased to 90 days and has now been increased to 120 days. The IMU depot must also evaluate gyro bias stability in order to assure that the ground alert requirement is satisfied. Since it is not logistically practical for the depot to incur IMU turnaround times of 42 days (Ref: system design requirement for 42 day bias stability), a 14-Day Gyro Bias Stability (hereinafter referred to as Long-Term Bias Stability (LTBS)) test is performed. The LTBS test consists of a minimum of seven azimuth drift tests, performed a minimum of one day apart over a minimum period of 14 days. The gyro bias change trend is determined by calculating the slope of a "least squares fit" line, using the data obtained from the seven azimuth drift tests (azimuth drift changes equate to gyro bias changes). The gyro bias change trend, in units of degrees-per-hour per day, thus can be used to project the gyro bias change for a 42-, 90-, or 120-day period.

Although 14 days is significantly less than 42 days of turnaround time, it still presents a significant logistics cost to support the LN-15 IMU. Depot turnaround time is a factor in computing the number of spares required to support a system; the longer the turnaround time, the greater the quantity of spares required. In an effort to enhance the availability of serviceable IMUs for field use, the Aerospace Guidance and Metrology Center, Directorate of Maintenance requested that the Directorate of Inertial Engineering investigate the feasibility of eliminating or shortening the LTBS test.

The Sequential Sampling Alternative

The engineering study led to the conclusions that the LTBS test should not be eliminated and that gyro bias stabilization time could not be reduced by temperature cycling of the IMU. However, a scheme was developed for making decisions to accept or reject an IMU earlier than the 14th day of LTBS testing. The accept/reject criteria was developed from empirical data obtained from a control group of 51 IMUs which underwent LTBS testing. The scheme is similar to the statistical technique of Sequential Sampling. The accept/reject criteria is depicted graphically in Figure 1 and in tabular form in Table 1. The number of the azimuth drift test performed is

Table 1. Sequential Sampling Accept/Reject Criteria for Long Term Bias Stability Testing of the LN-15 IMU (in cumulative degrees-per-hour per day)

Drift Test Number	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Reject If* ≥	.01000	.00663	.00458	.00334	.00259	.00213	.00186	.00169
Accept If ≤	.00055	.00077	.00099	.00121	.00143	.00143	.00143	.00143

*Reject if any drift differs from the first drift by 0.030 degrees-per-hour or more

the abscissa of the graph. As noted earlier, the LTBS test required a minimum of seven (7) azimuth drift tests; however, the number of tests has been limited to ten(10) on the premise that a gyro which has not stabilized by the 10th drift is unreliable. Cumulative gyro bias change trend is the ordinate of the graph. The Cumulative Trend scale is linear from zero to 0.00143 and exponential from 0.00143 to 0.01000. The accept and reject boundaries of Figure 1 differ from the classic sloping parallel lines forming the Sequential Sampling accept and reject boundaries. The converging nature of the boundaries in Figure 1 is attributed to the increasing confidence in the trend value as additional data points are used in the "least squares" calculation of the slope (trend). Figure 1 does not permit an accept or reject decision until the third azimuth drift in order to have sufficient confidence in the calculated trend value.

In reviewing the LTBS test results of the control group of 51 IMUs, it was noted that when an IMU exhibited a change in azimuth drift of 0.030 or more degrees per hour from the first azimuth drift to any other azimuth drift, the IMU eventually failed the LTBS test or failed the IMU final acceptance test. This observation was the basis for establishing the azimuth drift change limit of 0.030 degrees per hour.

Applying the criteria of Figure 1 to the data obtained from the 51 LTBS tests, early decisions to accept or reject IMUs could have been made on 31 of the IMUs for an average savings of 3.871 days per IMU in the group of 51 IMUs.

In this sample of 51 IMUs, none would have been accepted or rejected incorrectly by the Figure 1 criteria.

Although the accept/reject criteria presented in this article is specifically for LTBS testing of LN-15 IMUs at the Aerospace Guidance and Metrology Center, the idea is applicable where any lengthy testing is required. Empirical data may be used to tailor the accept/reject boundaries for the specific application. The benefits which will be realized by AGMC upon approval by the IM will include reduced turnaround time, a reduction in labor standards, a reduction in support equipment utilization time and an increase in morale among the test technicians, because of the elimination of "perceived" wasted time.

Sequential Sampling Accept/Reject Criteria for Long Term Bias Stability Testing of the LN-15 IMU

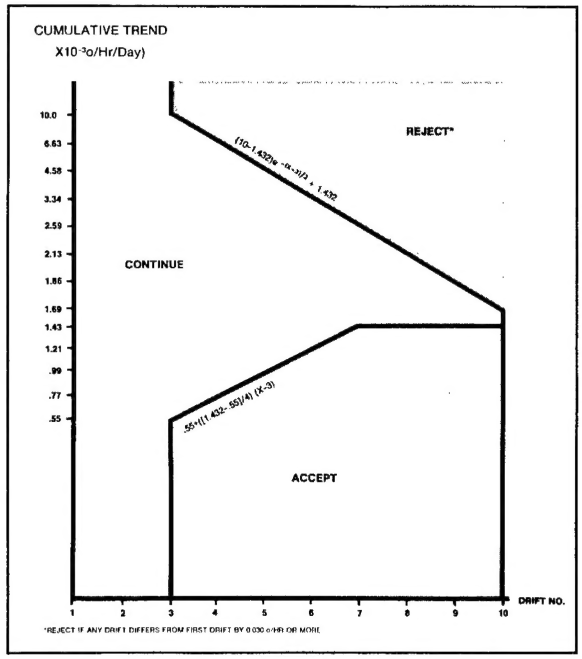

Figure 1.

References

(1) Dalton, Fred, "LN-15 14-Day Bias Stability Study Project A270(SNA)" Project Report, November 1979.

(2) *LN-15 IMU Overhaul Instructions*, USAF Technical Order 5N16-3-10-3.

Air Logistics Center Item of Interest

Modernization of Gyro Repair

During 1973–75, Project "Pacer Torch" was implemented at AFLC and established the concept of repairing items that were generally similar in specialized technical repair centers. As a result, repair of 107 kinds of gyros, representing 350,000 man-hours of workload, was shifted from Oklahoma City ALC (OC-ALC) to Warner Robins ALC, although item management responsibilities remained at OC-ALC. While the shift was made with relatively few significant problems, the 1940 vintage test equipment used to repair the gyros was aging and rapidly becoming too obsolete to insure acceptable quality levels for today's complex navigational gyros. In 1977, a Battelle Company study concluded that new test equipment, new technical data, and new processes were required to meet present and future technology requirements. Currently, the implementation program is on schedule and includes segmented delivery to allow step-by-step installation of the new equipment to avoid production delays. In short, each new block of equipment will be operational before the corresponding old portion is removed. OC-ALC/MMI participated in the preparation of the statement of work for the new test equipment and will be responsible for appropriate revisions to applicable technical orders. The program is scheduled for completion in July 1982. (OC-ALC/MMIM, Danny Lovelace, AUTOVON 735-2230.)

The Use of Minicomputers In MAJCOM Logistics Management

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In recent years the civilian business community has witnessed a movement to the application of minicomputers and microcomputers in information management. These devices offer attractive advantages such as low cost, rapid real-time summary and feedback of information, programming flexibility and responsiveness, and direct user control of hardware and software. Logisticians at Major Command (MAJCOM) headquarters have gained from these advantages by obtaining minicomputers and using them to help manage logistics functions. The results have been most encouraging. This management initiative has increased productivity by getting people out of the manual number crunching and chart making business. It has also increased interest and improved attitudes toward the use of computers in logistics management. Probably the most noticeable positive result of these minicomputer applications is that they have helped managers gain better control of their logistics system in the face of continued manpower reductions.

The following brief examination of the evolutionary development of the use of desk-top computers at the MAJCOM level in the Air Force and the current applications in two specific commands provides some useful insight about Air Force logistics, now and for the future.

Background

The application of minicomputers to MAJCOM logistics got its initial push from the Logistics Management Information System (LOGMIS) program. The development of LOGMIS was recommended at a 1973 World Wide Logistics Conference to improve MAJCOM logistics management information systems. LOGMIS was originally conceived and planned as a standard AF system. However, after the initial development of LOGMIS it was determined that, because of the diversity in specific MAJCOM needs, a command unique approach would be more appropriate. The program's goal was changed to command unique information system development and it's name was changed to Command Logistics Information Improvement Program (CLIIP).

One of the key MAJCOM problems recognized in CLIIP was not the lack of data collection systems but the effective utilization of those in existence. Simple data retrieval seldom satisfied the need for information. The manual processes involved in analysis and presentation lengthened the time between question and answer. In some situations, decisions were forced before supporting data could be located, retrieved, analyzed, and presented.

For several years the MAJCOMs, the Air Staff and the Air Force Logistics Management Center (AFLMC) worked together under CLIIP to improve the usefulness of logistics data at the MAJCOM. Although CLIIP, like LOGMIS, has been officially terminated (in mid-1979), it provided impetus for progress. The legacy of both programs is a relatively new but rapidly expanding use of minicomputers to improve the management of a variety of MAJCOM logistics areas.

MAJCOM Applications

Air Training Command (ATC)

Air Training Command's experience in this area began early in the LOGMIS program. Tasked by the Air Staff to develop LOGMIS, ATC's effort involved the purchase of a Wang System 2200 minicomputer. The system was set up in the Logistics Analysis Support Division of the Logistics Plans Directorate under the DCS/LG. During CLIIP, the ATC/LG minicomputer operation was expanded further.

THE EQUIPMENT

Since purchase of the original equipment, the operation has expanded to a two system configuration with the following equipment and capabilities:

System 1 - Wang 2200 C
- 32 K memory with cassette tape storage capability
- 5 Megabyte Disk Drive
- Card Reader
- Printer (125 lines/min)
- Basic Language

System 2 - Wang 2200 MVP
- 64 K memory (expandable to 512K) with mini-diskette storage capability
- 10 Megabyte Disk Drive
- Printer (220 lines/min)
- Basic II Language

Two programmers are currently assigned to handle the programming for both systems.

The ATC/LG minicomputer operation supports all five LG directorates: Maintenance, Supply, Transportation, Contracting and Plans. In addition, other HQ ATC functions, such as Operations and Technical Training, have used the minicomputers for special studies and other management applications.

THE OUTPUT

Since acquisition of the original equipment the ATC/LG minicomputer operation has grown at a rate of approximately 25 additional programs a year to the current state of 149 on-going application programs. In addition, two extensive monthly logistics publications are produced by the minicomputers from permanent data bases and distributed to ATC units and other interested Air

Force organizations: the SABRE (Supply Automation for Better Responsiveness and Efficiency) and the Air Training Command Maintenance Summary.

The SABRE is a monthly report that presents information to ATC managers on the health of the supply system in ATC. It includes monthly statistics on T-37 and T-38 MICAP requisition hours and other supply effectiveness measures for all ATC bases.

The Air Training Command Maintenance Summary is a management tool for ATC maintenance managers that performs a function similar to what the SABRE does for Supply. It contains 12 months of aircraft sortie and flying hour data for all ATC flying units. The report also contains 12 months of maintenance data including NMCM rates, maintenance man-hours per flying hour, aircraft utilization rates, and maintenance trend statistics for selected aircraft systems.

The following is a summary (organized by functional directorate) of some of the other major information systems on the ATC/LG minicomputers.

MAINTENANCE

Sortie Deviation System - Identifies maintenance problem areas that impact the ATC flying training mission. The program uses a real-time investigative process to identify harmful trends in aircraft system failures before they get out of control.

System Occurrence Graphs - A series of periodically produced charts depicting sortie deviation rates by WUC (Work Unit Code) and/or system. The program identifies bases that exceed statistically established control limits to help maintenance analysis pinpoint potential and real problems.

Aircrew Training Device System - Compiles and summarizes aircrew training device data. The system's output products provide maintenance information on all aircrew training devices in ATC.

Weekly Aircraft Maintenance Status Briefing - This program produces charts, from aircraft deviation data, that are used to brief the LG on the status of problem areas in ATC aircraft maintenance. The LG uses information from these briefings to make decisions affecting ATC maintenance policies.

SUPPLY

Energy Data System - Accumulates statistics from an energy data file, which is updated monthly for all ATC bases, and produces a report showing energy consumption against assigned goals.

Base Supply Rating System - Used to evaluate the efficiency of base supply management at each ATC base.

Vehicle Buy/Allocation System - Provides a current record of vehicle allocations and redistribution orders. Output reports are used to manage the ATC vehicle program.

CONTRACTING

Contract Management System - Produces reports from a data file that contains performance information on the ATC contracting function. The reports include the Contract Management Data Report, the Base Performance Summary, and the Base Contract Performance Summary.

Small Business/Competitive Procurement System - Compiles statistics and produces output products that give information on the health of the Small Business and Competitive Procurement programs in ATC.

TRANSPORTATION

ATC Vehicle VOC Analysis System - Accumulates information from a data file and computes statistics that are used to help manage all Air Force and GSA rental vehicles at ATC bases and USAF recruiting activities.

Administrative Airlift Support System - Compiles and reports statistics that are used to evaluate the effectiveness of MAC airlift support of ATC requirements.

The LG Administrative Section also has information systems on the minicomputers, including a TDY program which is used to record, project, and report on the status of TDY travel for the ATC/LG.

This summary does not include all of the information systems supported by the ATC/LG minicomputer operation. But it is a representative sample that illustrates how the operation is a useful management tool for ATC Logistics. It is an accepted fact among ATC logistics managers that the minicomputer products have provided them with an information source that has saved manpower, increased productivity, and helped to identify management problem areas.

OTHER USES

The ATC LG minicomputers are used for more than the on-going production of management information reports. On occasion, they have been used to conduct special studies. For example, they were used to conduct a UPT-IFS (Undergraduate Pilot Training - Instrument Flight Simulator) student loading simulation. This simulation study was used to project future usage of the UPT-IFS by entering UPT classes. Another example was a study that successfully identified the relationship between temperature extremes and hydraulic leaks in the T-38 landing gear system.

Recently, ATC moved into another potentially ripe application area by developing an ATC logistics capability model on one of the minicomputers. This system was designed as a real-time question and answer simulation model for use during exercises and future contingencies to evaluate the combined logistics impact of flying training mission increases and personnel deployments.

Strategic Air Command

Strategic Air Command (SAC), like many other Air Force MAJCOMs, also had the need to develop ways to more effectively use its existing information systems. The SAC approach was to justify and acquire a powerful desk-top computer system for direct use by headquarters logistics staff agencies.

THE EQUIPMENT

The desk-top system, a Hewlett-Packard 9845-S, has approximately 63K bytes of user programmable memory, two internal tape cartridge drives (217K bytes on each tape) and an internal thermal graphics printer. External peripherals include:

- Two floppy disk drives (500K bytes each)

- HP 2631A printer (180 characters per second)
- Card reader
- Four color automatic graphic plotter

In addition to the self-contained statistical and graphic capabilities of the desk-top computer a direct connection was made to the MAJCOM Honeywell 6080 computer for access to logistics data.

An additional requirement in the initial acquisition of hardware was that formal training be provided by the manufacturer in the operating and programming language (Basic) for action officers /NCOs in each logistics agency. As a result, there are personnel in each agency capable of developing computer routines to satisfy their own agency's informational and presentation needs. Access to the desk-top computer is on an "as required" basis, and to improve accessibility, two more stand-alone systems are scheduled for delivery.

THE OUTPUT

The capability to build "self-help" automated programs within logistics has spurred imaginative thought in problem solving and has begun to provide timely information in formats ready for presentation. The self-help desk-top computer programming process is basically a "try-improve-revise" approach. If the first product presented does not fully satisfy the user or prompts additional ideas, it can easily and quickly be revised until it is "tailor made" for the user's application. In this process there is a distinct advantage to having an aircraft maintenance product developed by an aircraft maintenance professional or a supply product developed by a supply professional. A subsequent user has the option at his fingertips of further revising or even rewriting the routine to fit current requirements. For large, recurring products which could be more efficiently accomplished on a large computer, the desk-top system provides the means to develop, test, and validate the product before submitting a formal Data Automation Requirement. It also provides the user a more definitive base from which to write detail specifications.

The SAC logistics desk-top computer system was installed in June 1979. Although the relatively short period following installation has been heavily inundated with training and machine familiarization, the results thus far achieved in information improvement for the functional manager have proven the enormous potential of the system. A sampling of the in-house logistics routines developed to this point are as follows:

Work Unit Code (WUC) Analysis

- Selects work unit codes from MAJCOM Maintenance Data Collection (MDC) file which have at least "X" failures (user input to eliminate from consideration low failure Work Unit Codes (WUCs) in 12 months).
- Provides user options to select only WUCs with deteriorating Mean Time Between Failure (MTBF), low MTBF or combination.
- Computes trend line, performs statistical tests and produces both a graphic product and a hard copy listing of detail data.

Manpower Tracking

- Tracks by AFSC authorized spaces in SAC, personnel assigned, shortages, projected losses, etc. Manual update.

Contingency Sortie Rate Model

- Performs simulation for planning and scheduling contingency resources. Estimates sortie rates. Interactive program—over 50 user controlled variables.

LG TDY Funds

- Tracks TDY funds by fiscal year. Provides graphic product by directorate.

JP7 Inventory and Consumption

- Provides trends on consumption and receipts on JP7.

Summary

All of these examples point out that the potential for application of these minicomputers is limited only by the imagination of managers, analysts, and programmers. The experience of ATC, and more recently SAC, indicates that there is definitely a place for the minicomputer in the military logistics management arena. Their operations, differing in approach yet similar in successful results, could serve as models for potential applications in other military organizations.

Most Significant Article Award

The Editorial Advisory Board has selected "Air Force Logistics Doctrine" by Major James D. Gorby, USAF, as the most significant article in the Winter 1980 issue of the *Air Force Journal of Logistics.*

USAF LOGISTICS POLICY INSIGHT

More SAFAL Major Logistics Policy Goals for 1980

☐ Establish competitive basis for airlift contracting.

☐ Improve supply support through fact-of-life approaches to inventory management; e.g., reduction in number of high priority requisitions, enhanced peacetime operating stock levels, and more realistic expressions of safety level and leadtime requirements, stock availability by weapon system, etc.

☐ Continue to promote the Productivity, Reliability, Availability and Maintainability (PRAM) and Modular Automatic Test Equipment (MATE) programs by special attention.

Logistics Planning Policy and Guidance

Annex E of the USAF War and Mobilization Plan provides the information necessary to plan, attain, and maintain logistics support for wartime forces. Over the past year major changes have been made to the objectives, assumptions, responsibilities and planning factors sections of Annex E. These included changes in guidance for wartime resource requirements determination, acquisition and distribution. Currently major changes are being developed in the basic strategies for supply, maintenance, transportation, and munitions support. Annex E should be a key reference for MAJCOM wartime logistics support planners.

Operational Validation Program Using Shale Oil Derived JP-4

On 1 December 1979 the Deputy Chief of Staff Logistics and Engineering (AF/LE) was tasked by the Air Force Vice Chief of Staff (AF/CV) to develop an operational validation program for JP-4 derived from shale oil. The program will be similar to the United Kingdom JP-8 conversion program. This approach is needed at this time to capitalize on the potential to produce shale oil JP-4 now existing in the petroleum industry. A planning conference was held 23 - 24 January 1980 and a final Program Management Document was scheduled to be published in March 1980. It is planned to provide about 5,000 barrels per day of shale oil JP-4 to two bases starting in 1983 - 1984.

Contracting Initiatives

The Air Staff Directorate of Contracting and Acquisition Policy has several initiatives for 1980. Increasing the use of commercial item descriptions in lieu of detailed military specifications is being studied. Changes are underway to consolidate warranty procedures to facilitate their administration. A forthcoming regulation will assign responsibilities for contract administration services to be performed on AF installations in support of major weapons systems. Performance oriented statements of work and contractor quality control systems will be introduced to base level service contracting. Competition goals will assure that former sole source acquisitions are critically reviewed. The implementation of PL 95-507 and requirements for the submission of subcontracting plans for small/disadvantaged businesses is being closely monitored.

Reliability and Maintainability

HQ USAF, AFSC and AFLC have taken strong actions to implement the policy in AFR 80-5, *Air Force Reliability and Maintainability Program.* Reliability and Maintainability (R&M) manning and training is being evaluated and program documentation is reviewed for emphasis on R&M. AFSC has approved a new headquarters function in reliability, maintainability and quality assurance responsible for evaluation of R&M policy implementation. The objective is to integrate R&M requirements into systems design.

Maintenance Data Collection (MDC) System

The DCS/L&E has approved plans to modify the MDC system. The initial thrust will be development of support general job standards to be used in lieu of AFTO Form 349 documentation by maintenance technicians. This method of data collection has been tested at three bases. Test results have shown a 30 percent decrease in overall MDC system documentation requirements and significant impovements in data accuracy. The new data collection form, B3500 programs and technical order changes required for implementation are scheduled for release in September 1980.

Integrated Logistics Support

Integrated Logistics Support Policy has undergone significant revision in the last year. DOD has published a new ILS Directive (DODD 5000.39, date 17 Jan 80) to replace DODD 4100.35. The Air Force implementing regulation (AFR 800-8) was published on 7 Feb 80.

Logistics Considerations in Mission Element Need Statements (MENS)

In November 1979 the DCS/L&E initiated action to elevate awareness of logistics supportability to the sustained operational effectiveness of AF weapon systems. New policy guidance documents on logistics considerations in MENS will be included in AFR 57-1, *Statement of Operational Need.* The objective is to ensure that supportability is given equal consideration with cost, schedule and performance during system acquisition.

Conductivity Additive in Jet Fuels

In 1979, the Air Staff (AF/LEY) approved the use of conductivity additive in JP-4 and JP-8. The decision followed two years of testing and evaluation at the Air Force Propulsion Laboratory and selected bases. The additive dissipates static electricity charges built up in aircraft and ground fuel systems during servicing and has been used by the airlines and other governments for some time. The Air Force decision to use the additive resulted from recent cases of ignition inside various types of aircraft and bulk handling equipment/facilities. Implementation is being managed by the San Antonio Air Logistics Center (SA-ALC/SF) on a phased worldwide schedule as testing equipment and facility modifications are available.

Do It Yourself (DITY) Moving Program

The DITY method of moving has been available to Air Force members since June 1976. It has proven to be an increasingly popular way of transporting personal property for members of all grades. Members who utilize DITY are eligible to receive a monetary incentive equal to 80 percent of the cost the Government would have paid the commercial movers less the actual DITY costs.

52,018 AF DITY moves were made during the period 1 June 76 through 30 Sept 79. Savings to the Government totalled $5,939,017 and AF members received $11,391,317 in incentive payments.

TMOs also benefit in that DITY provides flexibility in meeting short movement dates plus an option to consider in planning for peak season requirements. Base commanders and Resource Managers benefit in that local DITY moves conserve O&M dollars.

The Soviet Air Force Supply System

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Research on the Soviet Air Force logistics system has not attracted widespread attention in the past, yet no assessment of the Soviet Union's capability to wage war can be complete without an understanding of their logistics. The objective of this article on the Soviet Air Force supply system is to enhance that understanding by describing the current posture and projecting the system configuration into the near future.

The reader should be aware of several facts about the source, timeliness and accuracy of much of the basic information.

First, unclassified research on the subject is almost non-existent. There are few American sources referred to in this paper because few could be found.

Thus, second, the majority of information sources used in this effort are Soviet military journals and press releases. While the accuracy of these primary sources may be challenged, the information presented in different Soviet sources appears to convey the same or similar comments relative to their supply system.

Third, although the most current information has been used of the small unclassified amount that is available, much of it is from the mid 1970s. Major changes could have been made or started within the past few years.

Finally, some of the observations about the Soviet Air Force supply system have been inferred from descriptions of Soviet logistics in general and other Soviet services systems as well as the author's own experience in providing supply support to USAF flying operations. While these inferences may be incomplete, the comparisons and contrasts with the USAF's supply operations put both their and our system in better perspective.

ORGANIZATION

Rear Services

The Soviets recognize logistics support as the link between the national economy and the military (1:25). The Leninist principle of centralization, which governs the control of the overall economy, also dominates the operation of the rear services (logistics) entities throughout the chain of command (1:36). At the apex, the Chief of the Directorate of Rear Services is responsible for coordinating all logistics support requirements for all branches of the Armed Forces. He also is directly responsible for the procurement and supply of food, quartermaster type services, fuels, and medical and veterinary services (20:16).

The commanders of the Soviet Army, Navy and Air Force use separate channels to procure weapon systems, vehicles and specialized equipment (20:17). Consequently, the Soviet Air Force obtains aircraft parts and service peculiar supply items from sources outside the Soviet Rear Services logistics system. It is the opinion of the author, however, that the Chief of Rear Services develops logistics management policy which governs the Soviet Air Force logistics system and that of the other service branches.

Under these conditions, with the Chief of Rear Services providing direction to all logistics units at all levels of command, the requirements for coordination among the component services and the Rear Services appear immense.

Line and Staff Functions

Logistics management by the Rear Services of the Soviet Union encompasses logistics as it is most broadly defined, including civil engineering and medical services. There is wide duplication of functions and overlapping of responsibilities for supply support in the headquarters staff (1:28). The functional staff elements such as "accumulation of supplies" and "transportation of supplies" have counterpart supervisory or control functions in the headquarters staff. This is in accordance with the general principle of "continuous direction by the command, staffs and rear services entities over the activities of rear services subunits, units and establishments and coordinating working on uninterrupted provision of all necessary supplies and services to the troops" (1:26).

To maintain this logistics control, independent control entities are established at all levels. There are operational rear services directive entities such as Chiefs of Rear Services with their logistics staffs and rear services support elements. In the field, these control units are headed by logistics personnel with the title of Deputy Commander for Rear Services (1:35).

This desire to maintain centralized control throughout the Rear Services extends to the lowest level of operation. In one account of the deployment of a mobile helicopter unit to an unimproved airfield, support equipment and supplies had to be shipped to service the aircraft at the forward location. To maintain control over the assets, an officer—a senior lieutenant acting as Deputy Commander for Rear Services— was deployed with the shipment (17:119). Under similar circumstances, the USAF does not hesitate to send non-commissioned officers to maintain control over deployed aircraft parts and equipment.

The Aviation Technical Unit

"The Aviation Technical Unit is the basic support unit of the Soviet Air Force" (10:100). It provides materiel, airdrome-technical and medical support to Soviet aviation units. The level and range of supply support provided by the aviation technical unit depend upon the type of aircraft assigned and the types of maintenance performed at the unit. Items such as hand-held test instruments and test equipment are supported by the aviation technical unit. In fact, there are several factors which indicate the existence of a full-range of expendable and recoverable supplies at the field level.

Scheduled maintenance for air mobile helicopter units, for example, is performed in the field which necessitates the pre-positioning of expendable and recoverable supplies.

The existence of aircraft maintenance workshops indicates that recoverable parts can be repaired to some extent at the base or field level as opposed to being shipped to a central or intermediate repair facility (18:3).

Finally, there are two types of aircraft maintenance in the Soviet Air Force: the first based on a cycle; the second on the passage of time (13:106). The cycle maintenance is accomplished on an incremental basis after each flight. Other maintenance is performed with the passage of certain time periods, i.e., flying hours. These concepts of maintenance require support with both expendable and recoverable spare parts. It does not appear logical that the Soviets would inspect an aircraft after flight, find a discrepancy and then fly the aircraft to a central repair facility to have the discrepancy corrected.

The range of supplies required to support the Soviet Air Force is reduced by their use of standardized parts and major assemblies in different types of weapon systems (6:18). This is supported by the view of the technological balance between the USA and USSR which indicates that the USSR is clearly superior in commonality of components, ease of maintenance, and simple systems for common use (15:34).

In general, the primary difference between the USA and the USSR in the utilization of military materiel is that the USA does not maintain centralized control over the actual utilization of all supplies. Rather, we have an arrangement of decentralized wholesale level management of supplies by the Defense Logistics Agency (DLA) and the respective branches of the military service with no centralized control over the actual utilization of supplies.

Even on the surface, the Soviet's system appears unwieldy. "The Deputy Commander for Rear Services coordinates with the Chief of Engineering, Chief of Chemical Services, Unit Commanders, rear services at division and headquarters levels, and service chiefs" (12:44). Apparently the requirement for coordination with various activities has not changed since World War II while there have been changes in USSR logistics support methods (12:43). The Deputy Commander of Rear Services at a Soviet base is required to deal with many more echelons of command than the Chief of Supply at a USAF base in order to acquire supply items. This makes the task of stocking required supplies exceedingly cumbersome and a lengthy process at best for the Soviet Air Force supply officer.

A detailed look at the support planning process is even more revealing.

OPERATIONS

Supply Support Planning

The commander in the field determines what is required to accomplish the mission. He develops the sequence of support required, the expenditure of supplies, and a timetable for supply replenishment. He is advised in this area by the chief of his respective service and the field level Deputy Commander for Rear Services (1:29). A somewhat conflicting account indicates that the overall plan for supply support is developed by the Deputy Commander for Rear Services and the field commander determines the system to be followed in distributing the materiel resources (9:78). The actual determination of supply requirements, control over the issue of supplies, and replenishment requirements is probably a joint venture with the staff work being accomplished by the Deputy Commander for Rear Services.

To obtain ground troop supplies, the plan for supply support is forwarded through logistics channels and the direction to execute supply support is communicated by rear services functions to the executing entity (materiel release function) via rear services order or instruction (1:30). The emphasis on the control function in the utilization of supplies would infer a similar process in the Soviet Air Force.

Apparently a list of all required supplies is developed by the Soviet Air Force and the support responsibility is negotiated and finalized on a line item basis with the Chief of Rear Services. Again, the need for detailed coordination with rear services units is necessary for the Soviet Air Force to provide supply support.

The supply support planning and decision making processes are simultaneous to the maximum extent possible. Rear services calculations of the quantities of items required are completed and the expenditure of supplies is determined in the course of the decision preparation (1:30).

Based on information known about Soviet Army support, the supply requirements computation process is derived from two broad categories of available data. The first category is information on the composition, position and change of position of rear services subunits, units and establishments. The second category of data relates to requirements, availability of supplies and the volume of work to be performed (1:27). There are established rates of consumption and the Soviets indicate that these should be used in exercises to determine the required distribution.

It is difficult for the Soviets to develop unified support plans for the entire range of supplies. Their experience indicates that the principle time expended in support planning is devoted to developing logistical support requirements calculations, particularly in the area of transportation (1:30). This indicates that the requirements computation process may be a manual operation.

These planning and requirements computation problems are minor relative to the difficulty the Soviets have in accounting for the supplies they actually possess.

Supply Accounting

There is no standardized method to account for supplies in the Soviet military. The various branches of Soviet military service do not have standardized accounting forms. Rather, each of the services developed their accounting forms at different times in a vacuum. In addition, there is little compatibility in the forms and their content within the same service (19:74).

The principle recordkeeping documents are material recordkeeping ledgers and cards, stocklists and waybills, supply release documents, supply requisitions, and report documents. A large volume of data is contained in the various materiel recordkeeping documents. These documents contain quantitative information (balances) as well as qualitative information (cost, condition, etc.) (1:34).

The Soviet policy for supply accounting at the control points throughout their chain of command requires three types of information: statistical, operational and documentary (19:73). With no standardized method of maintaining supply documents, the Soviets do not have a very efficient method of reporting the qualitative and quantitative information in their logistics system. While the Rear Services Headquarters and Soviet Air Force Headquarters may provide the formats for required supply information, it appears to be an extremely difficult

task for field level supply units to extract and report supply data.

The variety of supply documents combined with attempts to maintain centralization of control causes the Soviets to lose accuracy in reporting supply information. The problem is compounded by the lengthy processing path for supply documents. As an example, a supply action such as the shipment of materiel is not completed until the shipping document is received at the final shipping destination, processed there and received back at the shipping unit. The Soviets note that the time involved for such documents to complete the cycle could be several months (19:73). Thus, the shipment of supplies could be physically received at the final destination, but the shipping organization would not realize this until the document was received several months later. In contrast, the USAF's automated system, the Air Force Recoverable Asset Management System (AFRAMS), provides feedback information to the inventory manager (shipper) the day after the asset is received at the final shipping destination.

Under such conditions, it is difficult for the author to comprehend how the Soviets maintain records of supplies in a transit status. It would appear that the Soviets consider an item in transit until the shipping unit received the shipping document back from the final shipping destination. Because of the untimely and inaccurate information on the actual location of in transit assets, a large volume of supplies in a transit status tends to weaken the credibility of actual supply balances at any particular point in time.

The Soviets pride themselves over the improvement in bookkeeping at a depot level aircraft parts storage function where the storage of aircraft spare parts is by inventory number. This was considered a vast improvement over the previous method of accounting for parts by alphabetical means, but indicates that the Soviets were not using automated accounting methods for aircraft spare parts at the wholesale level (7:112-114). The existence of automation elsewhere in the system is sporadic at best.

Automation

Information from 1974 indicated that the Soviets were using computers in complex transportation and supply problems related to ground troop support (14:28). It is reasonable to consider that the same computer expertise could be used to solve Soviet Air Force supply problems; however, the author's review of Soviet publications did not identify information which would indicate that this was being done.

As of 1976, there was no overall computerized materiel information system in the rear services (1:23). A year earlier, the Rear Services Headquarters had just received calculating machines to speedup the work of maintaining control over their materiel (19:74).

The extent of automation of aircraft aviation engineering property records is not known, but it does appear to be a step above completely manual recordkeeping. By the mid-seventies the Soviet Air Force was maintaining aviation engineering property records on perforated and magnetic tapes (19:75).

The Soviet Air Force appears to have computerized the recordkeeping on what is termed aviation technical equipment and munitions, but this represents a small fraction of the total range of supplies items required to support aircraft maintenance operations at the field and depot levels. This comment is based on the author's experience in providing USAF aircraft maintenance organizations with supply and equipment support at base level.

The Soviets do recognize their deficiency in this area. As of the 1975-1976 timeframe, a comprehensive plan for the development of an automated logistics information system was included in the book, *Automating Management of the Rear Services*. It was intended for Soviet logistics officers, students enrolled in logistics schools and others who were engaged in the automation of management processes. The book covered some "methods" aspects of the steps which would be required to transition from a nonstandard system which was essentially manual to an automated management system (1:19-20). It will be a large task for the Soviets to transition from an essentially manual system with many different formats to a standardized automated accounting and information system. While the Soviet Air Force has begun to automate their supply records, it is not known if the Soviet Air Force developments will be used as the prototype for the logistics information system throughout the Soviet military.

Supply Storage

The Soviet Air Force is faced with the expensive problem of upgrading their warehouse facilities. In 1975, Lt Colonel Yu Kashkovich said, "Many warehouses have old style storehouses with wooden framework and a large number of columns which hinders full mechanization of all jobs" (7:115-116). To alleviate the problem of inefficient warehousing operations, the Soviets are replacing their aviation supply storehouses with what they call the "economic method" of construction. This method involves major construction of concrete and the incorporation of materiel handling equipment such as overhead cranes (16:99-101). They also store much of their materiel in containers which can be moved on narrow gauge rails between warehouses and onto the beds of trucks. Other supplies are stored in containers on fully loaded vehicles (16:101). This practice can significantly reduce the deployment time for supplies and equipment to forward locations.

Some property such as aviation technical property (weapon system items) is maintained in "prolonged storage". These items are periodically functionally checked to determine their serviceability and conformity with technical specifications. Segregated storage is provided for these "prolonged storage" items (7:114). This author contends that these items include recoverable aircraft spare parts because of the reference to periodic functioning checks. It appears that these assets would be used in a remove and replace type aircraft maintenance operation. Further, Soviet guidance requires these aircraft parts to be maintained in a combat ready status. Since these items are aviation technical property, are provided segregated storage, and are periodically checked, they may be considered as war readiness materiel.

Materiel is generally stored in separate warehouses by commodity type. This is evidenced by the treatment of aviation technical property which is usually stored in warehouses separate from general supplies. Occasionally, however, general supplies and aviation property are stored in the same facility (12:28).

The storage of aviation supplies is complicated by the lack of packing control. Some property is received at supply warehouses without packaging which requires the formation of work brigades to pack such property (7:116-117). It seems that the real necessity for the proper packaging of aviation technical property is not so much preservation in storage as protection during rapid shipment to maintenance activities. Also, the regular delivery of items from suppliers with changes in the types of packaging by the suppliers tends to complicate warehousing tasks (12:28).

In a deployed location at an alternate airfield, supplies were stored in temporary structures, but there was significant effort expended to maintain these facilities in a satisfactory condition. The account of a helicopter deployment indicated that adequate conditions were created at the alternate airfield for storing aviation technical equipment in some heated tents and special trailers.

Stock Control and Excess Materiel

There is evidence in Soviet sources which indicates problems in managing excess supplies at the unit level. There are above normal stocks of aviation technical supply items in the Soviet Air Force Rear Services. Specific mention is made of excesses in aircraft spare parts, aircraft engines and parts for tractors which are obsolete. The basic causes of these excess conditions are: buying too much property to reduce the chances for outages, requisitioning more than is required with subsequent hoarding, changes in aircraft repair plans, and unused items due to aircraft arriving from the factory with the same items installed (7:113).

These excess stocks are identified by a special aircraft engineer who is detailed to review the assets for possible excess declaration. In addition, excess assets which have been already identified are reviewed by the aircraft engineer for possible disposition. This method of reviewing supplies indicates that the Soviet methods for identifying excess items are not very effective (7:114). It appears that the Soviets are not prone to eliminate excess items from their inventories even when there is no known future need for the assets. The practice of having aircraft engineers review supply items to identify excesses is not effective. The author's experience indicates that the review of excess materiel by technical experts usually results in extended retention of the assets prior to actual disposal.

The stock control function is usually weak when technical experts must be detailed to review stocks to determine retention or disposal action. The general reluctance of the Soviets to dispose of anything adds to the problems involved in sound stock control policy and procedures.

CONCLUSIONS

The Leninist principle of centralized control over the utilization of military materiel in the Soviet Air Force complicates the aircraft support process. The coordination required between the Soviet Deputy Chiefs of Rear Services and their operational counterparts at all echelons significantly increases the requirements for planning and justification of materiel needs. This extensive coordination and control process tends to decrease efficiency in providing supply support to the units.

The actual effectiveness of centralized control over the utilization of military materiel is questionable due to the magnitude of the logistics functions in the Soviet military. Visibility of assets throughout their logistics system is obscure, In addition, the lack of standardized methods of accounting for supplies in the component military services tends to degrade the accuracy and effectiveness of supply stock information that is forwarded to the control units in the Soviet Air Force. This is supported by the Soviet accounts of their problems with identifying excess materials such as aircraft spare parts and spare aircraft engines. An effective information system would provide this data to the control units and facilitate the expeditious identification, redistribution or disposition of such assets.

The standardization of accounting methods in the Soviet Air Force and the development of record formats compatible with the overall information system requirements appear to be the biggest obstacle that the Soviet Air Force faces in the computerization of the supply system. They recognize this requirement and the problem has been addressed by the Communist Party Congress. While the development of a standardized computerized accounting system for military supplies and equipment is not an insurmountable task, the Leninist concept of centralized control compounds the issue. This control requirement will drive their supply system toward a "push system" based on control entity approval of supply support objectives at the field or unit level. Accordingly, this could continue to decrease Soviet responsiveness in reacting to rapid changes in supply requirements. In a "push system" of distribution, any changes in requirements for supplies would be identified at the field level and the new requirements would then be approved by the supply source. The push system in the Soviet Union would be predicated on a higher echelon identification of the new requirement for supplies which would support the Leninist principle of centralized control. When a higher authority other than the actual source of supply must review the requirement, responsiveness will be reduced because control entity review will take time.

In the final analysis, the current status of supply support in the Soviet Air Force at field level must be evaluated in terms of their success in the Arab-Israeli War of 1973. In 14 days, the Soviets were able to fly some 832 resupply missions; and some 13,000 tons of military equipment was carried into Egypt, Syria and Iraq (4:17). Although some of these assets came from Communist Bloc nations, the fact still remains that the Soviets were able to coordinate the massive move of material in a very short period of time.

In the context of this research of unclassified sources, it appears that the Soviets have the capability to quickly disperse significant quantities of supplies and equipment. While there is evidence to indicate a lack of standardization in the accounting for supplies in the Soviet military, the associated problems with nonstandard systems are not insurmountable.

The major weakness in the Soviet Air Force supply system appears to be the difficulty of quickly resupplying assets to forward aircraft bases because of the heavy requirements for coordination and the incompatibility of accounting systems. The control factor in the utilization of materiel during war conditions would tend to increase the time required for resupply. While accounts of truckers being prepared to dispatch at a moment's notice with

preloaded vehicles are evident, it appears that these supplies would be intended for use in a war of limited duration. It is conceivable that recoverable assets are not loaded on trucks for quick dispatch as evidenced by the Soviet methods of storing these assets in warehouses.

In general, the current level of sophistication in management and accounting for supplies in the Soviet Air Force may be roughly equivalent to the RAMAC 305 supply system which was replaced by the Standard Base Supply System (SBSS) in the USAF in the 1960s. This is not to say that significant improvements are impossible for the Soviet Air Force supply system in the near future, but it appears unlikely that the Soviets will develop a fully automated supply system with Chief of the Rear Services support interface before the mid 1980s.

REFERENCES

(1) Muzychenko, A. S., Baranyuk, V. A., Vorob'yev, V. I., *Automating Management of the Rear Services*. Moscow: Voyenizdat, 1976. (JPRS No. L/7501, December 1977).

(2) Bab'yev, Serv V., Lt General (USSR). "Need for Economy in Use of Military Resources Stressed". *Moscow Agitator Armii I Flota*, No. 15, (August 1977). (Translations on USSR Military Affairs, JPRS No., 69977, 17 October 1977).

(3) "Brief Reports from the Military Districts, Groups of Forces, Fleets, Directorates and Rear Services Institutes." *Rear and Supply of the Soviet Armed Forces*, No. 8, (August 1974). (Technical Translation No. FSTC-HT-23-524-75).

(4) Harvey, David. "Logistics Lines". *Defense and Foreign Affairs Digest*, Vol. III, No. 9, (September 1975).

(5) "Higher Quality for Combat Training". *Rear and Supply of the Soviet Armed Forces*, Vol. 3, (March 1977). (Technical Translation No. FSTC-1087-77).

(6) Hotze, William R., Captain (USA), Schott, Terry L., Captain (USA). "Soviet Logistics, How Good Is it?" *Army Logistician*, Vol. 26, No. 4, (April 1976).

(7) Kashkovich, Yu., Lt Colonel (USSR). "Organizing the Storage and Issueing of Aviation-Technical Property". *Rear and Supply of the Soviet Armed Forces*, Vol. 12, (December 1975). (Technical Translation No. AST-11501-042-76).

(8) Kurkotin, S. K., General of the Army (USSR). "These Workhorses— The Rear Services". *Soviet Press Selected Translations*, Vol. 78-1, (January 1978).

(9) Levchenko, N., Lt General (USSR). "Knowledgeable Management of a Military Economy". *Rear Services and Supply of the Soviet Armed Forces*, Vol. 8, (August 1974). (Technical Translation No. FSTC-HT-23-524-75).

(10) "Organization of Subordinate Aviation Units". *Air Force Magazine*, Vol. 60, No. 3, (March 1977).

(11) "Rear Services Work in Air Defense Aviation Units." *Moscow Krasnaya Zbezda*, (April 1977). (Translations on USSR Military Affairs, JPRS No. 69288, 21 June 1977).

(12) Savluchinskiy, R., Major General (USSR), and Savel'yev, R., Colonel (USSR). "The Guarantee of the Rear's Successful Work is in Efficient Cooperation". *Rear and Supply of the Soviet Armed Forces*, Vol. 12, (December 1973). (Technical Translation No. FSTC-HT-23-14-75).

(13) Shylayfert, B., Colonel (USSR). "Equipment Operation and Maintenance Planning on Aviation Equipment". *Antiaircraft Defense Herald*, Vol. 5, (May 1976). (Technical Translation No. ADBO 19920).

(14) Turbiville, Grahm H., "Computers Speed Up Soviet Ground Force Logistics". *Army Logistician*, Vol. 6, No. 4, (July-August 1974).

(15) Ulsamer, Edgar. "The Accelerating Momentum of Soviet Military Might". *Air Force Magazine*, Vol. 61, No. 3, (March 1978).

(16) Volod'ko, N., Lt Colonel (USSR), and Kachan, N., Colonel (USSR). "Economic Method". *Rear Services and Supply of the Soviet Armed Forces*, Vol. 8, (August 1974). (Technical Translation No. FSTC-HT-23-524-75).

(17) Vorob'yev, B., Colonel (USSR). "At the Alternate Airfield". *Soviet Press Selected - Translations*, Vol. 78-4, (April 1978).

(18) Yurev, V., "Air-Mobile Technical Maintenance Unit". *Aeronautics and Cosmonautics*, No. 1, (January 1972). (Technical Translation No. AD-771-786).

(19) Zhovkovskiy, V., Lt General (USSR). "Standardization for the Accounting of Material Goods". *Rear and Supply of the Soviet Armed Forces*, Vol. 6, (June 1975). (Technical Translation No. AST-11501-036-75).

Official Documents

(20) Air Force Pamphlet 200-21, Soviet Aerospace Handbook. Washington: Department of the Air Force, May 1978.

Major Command Item of Interest

Strengthening the Command Awaiting Parts Program

Air Training Command has recently experienced an upward trend in MICAP incidents caused by excessive end items awaiting parts (AWP). Similar adverse trends exist for the number of end items AWP, the bits and pieces required for repair and the length of time the end items remain AWP. Staff visits to the bases confirmed a good overall knowledge of AWP procedures on the part of the monitors; however, there was a deficiency on the part of most monitors to aggressively identify and document problem items requiring extraordinary management attention. Once a problem item was identified, the final action on the part of most monitors was to make a phone call to the item manager to obtain status. Very few supply assistance, command assistance, or supply difficulty letters were initiated to try and resolve the problem.

In an effort to improve command visibility of the AWP program within ATC, the Weapons System Support and Supply Systems Management Divisions developed a command AWP Analysis Listing which provides a complete listing of all end items that are AWP within the command along with the component parts required for repair. This listing, in conjunction with another program which provides a daily asset position on critical repair components, provides our headquarters supply managers the necessary documentation for appropriate command assistance actions. The command is brought into the forefront of supply management actions without having to wait for message traffic initiated at the base level. This is extremely important since each base is unaware of the overall asset position within the command and may not advise the headquarters it is having a problem until it is too late. These efforts are part of a broader ATC self-sufficiency program managed by the Supply Operations Division, DCS/Logistics. Further information can be obtained by calling AUTOVON 487-2228. (Captain Charles K. Yard, ATC/LGSOA)

CAREER AND PERSONNEL INFORMATION

The Logistics Executive Force Inventory

A central concept to the operation of the Logistics Civilian Career Enhancement Program (LCCEP) is the Logistics Executive Force Inventory (inventory). The inventory is composed of all applicants who are qualified for GS-12 through GS-15 in a logistics occupational series. This includes individuals currently in non-logistics as well as those in wage series. A list of qualifying series may be found in paragraph 1-3a of AFR 40-110, Volume IV, which governs the LCCEP.

Why register in the inventory? Because voluntary registration is the cornerstone of participation and will provide many LCCEP benefits. Inventory members receive automatic consideration for approximately 389 career essential positions as they become vacant. Employees may specify where and for what grade levels they desire automatic consideration. Only inventory registrants may apply for the Logistics Executive Cadre (cadre). Individuals who are selected competitively for the cadre compete for 720 cadre reserved positions. Further, cadre members receive priority consideration for individual career planning and advisory service, career broadening and developmental assignments, long term full time training, and Air Force-wide promotional opportunities. Inventory registration opens the door to all of these benefits.

Registration is accomplished by submitting a completed AF Form 2675, Civilian Career Enhancement Programs (Registration and Geographic Availability), to the servicing Central Civilian Personnel Office (CCPO). This submission is necessary even if the registrant wishes to indicate availability only at the current geographic location. The CCPO is responsible for reviewing and determining the employee's eligibility. Those registrants who meet the necessary requirements will have their personnel records coded into the mechanized civilian personnel records to reflect inventory status. Once the employee receives the notice of eligibility from the CCPO, the employee's supervisor initiates an AF Form 2673, Logistics Managerial Potential Appraisal (LMPA). The supervisor submits this appraisal through appropriate command review channels and upon appropriate certification, the LMPA score is also entered into the mechanized civilian personnel records.

Does a relatively young and not widely experienced employee have a chance for selection to the Logistics Executive Cadre? Yes. Evaluation of GS-11s for cadre entry will stress potential rather than experience at this point in the employee's career.

Couldn't tight PCS funds in local offices, a fact of life these days, affect that aspect of the program designed to quickly move a member of the Logistics Executive Force into a key position in another geographic area? Yes, it could. And because it could, the Logistics Career Program Branch of the Office of Civilian Personnel Operations is studying the concept of centrally funding PCS costs for individuals selected to fill a centrally managed career program billet. If appropriate, the action would require budget cycle lead time to implement. The benefit to career program management is that selecting officials would be able to select the *best* candidate without constraint from lack of local funds availability.

Once an employee applies, can that employee modify geographical preferences or withdraw? The answer to both questions is a resounding yes! Employees are free to enter or leave the inventory at any time. Further, they may modify their geographical availability by submitting a revised AF Form 2675. Only the cadre process is, of necessity, limited to an annual window. The time period is announced Air Force-wide and appropriately publicized. If you feel that you qualify for this program and have a desire to further your career, visit your CCPO for additional information and assistance. The Office of Civilian Personnel Operations administers the total LCCEP, and can be reached at Autovon 487-4087 to fill in additional areas not resolved at the local level.

Does Early Logistics Experience Make a Difference in Senior Logistics Assignments?

A qualitative answer to this question would depend on one's frame of reference. Even the most objective response could be controversial, with the all-encompassing responsibilities (including logistics) of command at any level weighing heavily in the final answer.

A recent analysis, however, of general officer assignments to Air Force logistics positions does provide some quantitative data that may be of interest to *AFJL* readers.

For purposes of this analysis, *logistics experience* was defined as assignment to a supply, transportation, logistics planning or maintenance position. A *career logistician* was considered one who had logistics experience in each of the following ranks: 0-6, 0-5, 0-4 and below.

When this analysis was first made in 1977, the analyst concluded that no AFLC Commander since General Thomas Gerrity in the mid-sixties had any logistics experience prior to assignment as Commander. Now, the analyst notes, it is refreshing "that the present Commander of AFLC had two logistics assignments at the 2-star level and one at the 3-star level before being promoted to Commander, AFLC, in January 1978."

Not included on the tables are five Air Force generals assigned to logistics positions outside the Air Force. This group includes one non-rated, career logistician among the four who had at least one logistics assignment prior to their current duty.

The total current population of 35 includes 30 rated officers. Virtually all experience given credit as logistics, except AFLC experience, is in maintenance.

Logistics Background of General Officers in Air Force Logistics Positions

	1977	1979	1980
Air Force Total	32	32	30
Prior logistics experience*	16 (6)**	17 (5)	18 (5)
AFLC Total	20	20	20
Prior logistics experience*	9	10	13
0-6 only	2	2	4
Below 0-6	7 (4)	8 (4)	9 (4)
In AFLC	4	6	7
Air Logistics Center Commanders and Vice-Cdr	10	10	10
Prior logistics experience*	5 (2)	6 (1)	8 (2)
HQ USAF Total	5	5	5
Prior logistics experience*	5 (2)	3 (1)	3 (1)
MAJCOM/LG Total	7	7	5
Prior logistics experience*	2 (0)	4 (0)	2 (0)

*0-6 or below.

**Number in parentheses throughout the table identifies number of career logisticians.

PALACE BALANCE and PALACE BALANCE II: Retraining Overages into Critical Skills in the NCO Force

The problem of imbalances of noncommissioned officers between career fields has been of serious concern to managers at all levels for many years. Some career fields have had chronic overages in the middle and upper management grades. Others, including some sortie producing skills, have been chronically short.

In an effort to reduce the magnitude of imbalances, a voluntary retraining program known as PALACE BALANCE was begun in 1976. This program was keyed to two aspects thought to be attractive to the NCO force. The first was a personal contact format, where NCOs surplus to their fields were individually invited by letter to voluntarily retrain. The second, an incentive package, allowed volunteers to select career field and base of choice options, and offered two years of stability at the retraining location.

Since its inception, PALACE BALANCE has retrained over 3,000 NCOs in the top five grades from overage to shortage specialties. However, an in-depth analysis begun in late 1978 confirmed that imbalances remained a serious problem. This analysis showed that a concentration of significant overages in upper enlisted grades existed in a relatively few career fields. Conversely, shortages existed in smaller numbers across a much larger spectrum of career fields. Consequently, in May 1979, it was decided to expand the retraining effort to include both voluntary and selective retraining.

The expanded program, known as PALACE BALANCE II, concentrates on reducing surpluses in those fields with chronic NCO overages. Under PALACE BALANCE II, a specific AFSC with a large surplus of NCOs is selected and a numeric "retraining out" goal is established by grade. All eligibles in the identified grades are then contacted through individual letters, and invited to retrain voluntarily. They are told what the numeric goals are, and that selective retraining will be implemented if the goals are not met through voluntary actions.

Since its inception, PALACE BALANCE II has completed "retraining out" goals in two specialties—Vehicle Operations and Materiel Facilities, with goals of 350 and 428 retrainees respectively. Of the total 778 retrainees, 133 went to the sortie producing career fields—15 to avionics, 53 to aircraft systems, 16 to aircraft maintenance, and 48 to munitions and weapons maintenance. Another 140 retrained into the logistics plans area, a chronically short lateral specialty. Thirty moved into communications and electronics, while 167 went to the operations and command and control fields. The remaining 308 retrainees moved into other shortage specialties.

The original PALACE BALANCE program has continued in operation, working a broad spectrum of overage specialties against shortage requirements. PALACE BALANCE II has significantly reduced grade surpluses in two fields with chronic NCO overages. Working together, the two programs have made substantial inroads into the long standing problem of grade imbalances. Many highly competent, dedicated NCOs have retrained into sortie producing specialties, reducing shortages in the middle management grades. There are more to come in the future. (Colonel Clark H. Downey, Deputy Chief, Airman Management Division, Directorate of Personnel Resources and Distribution, AFMPC.)

"Do-It-Yourself" Logistics Engineering in Strategic Air Command

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The engineering support and direction Strategic Air Command gets from the Air Logistics Centers (ALCs) keep us logistically alive and healthy and on top of most of our problems. Our airplanes are ready to fly and our missiles ready to launch only because Air Force Logistics Command and the Defense Logistics Agency get the right parts to the right place at the right time, and because the engineers who work for our System Managers know when to call the airframes back for depot maintenance, when to order a TCTO to correct a deficiency, and when a subsystem needs a major retrofit change to keep it supportable.

And yet in SAC, we keep an in-house do-it-yourself aircraft engineering shop on our logistics staff and use them as problem solvers, troubleshooters, and engineering interface with the ALCs. Why do we do that, when I just indicated how much we depend on AFLC for engineering support? How have our engineers survived the recent lean years with too-short budgets and too-frequent headquarters strength cuts? Who are they and what is their contribution to SAC readiness that gives them a protective force shield that the ray guns of the manpower slasher can't penetrate?

A Thirty-six Year Tradition

First, who are they? They're a group of twelve engineers of various disciplines—aeronautical, mechanical, electronic—from PhD to bachelor degrees—with backgrounds in maintenance, acquisition, and operations. They're augmented by seven of the best senior maintenance technicians in SAC with many years of practical experience to keep engineering solutions in the real world, and by a supply technician to get the right kind of parts and equipment to support many one-of-a-kind development prototypes being built and tested. They've been around in SAC and its predecessor commands, off and on, since 1944 when Col C. S. Irvine, DM of the 20th Air Force, assembled a group of operational engineers in the Marianna Islands to work up power schedules and cruise control charts for the B-29, to extend its range and increase its bomb load. They did that well, and after the war the same group drew up plans to modify a B-29 for an unrefueled flight of 10,000 miles. The aircraft was modified by Oklahoma City Air Depot and Boeing Seattle to reduce weight. New performance and cruise control charts were made for the lightened aircraft, and in October 1945, Col Irvine flew it from Honolulu to Cairo, non-stop and unrefueled. Flight time and fuel remaining were within one-half of one percent of that predicted by the Operational Engineering Section. This performance opened up new vistas for the use of strategic air power and earned a niche for those engineers as the world's experts in cruise control.

At Headquarters SAC, Andrews AFB, Maryland, an engineering section was formed under Colonel Irvine to start plotting B-50 performance data. When HQ SAC moved to Offutt AFB, Colonel Irvine transferred to Walker AFB, New Mexico, as Commander of the 509th Bomb Wing. The engineers moved with him and became the 8th AF Operational Engineering Section (OES). Their work supported the first non-stop round-the-world flight of the B-50 Lucky Lady II in January 1949, refueled by prepositioned B-29 tankers. That history making flight proved the ability of in-flight refueling to extend the B-29 and B-50 to intercontinental range.

In 1950, the B-36 arrived in SAC and it soon became clear that operational reliability of that aircraft was far below expectations. The 8AF Operational Engineering Section was moved to Carswell and, with a co-located Air Materiel Command liaison office, was given a charter to supervise B-36 service testing and correction of operational deficiencies. After this move, they became the B-36 OES and staff supervision shifted to the Aircraft Projects Branch under the HQ SAC Director of Materiel. Their rapid success in correcting or uncovering deficiencies in the B-36 led to formation of another OES at Ellsworth to do the same job for the RB-36. Early in the fifties, additional engineering sections were formed by SAC at MacDill for the B-47 and KC-97, and in 1955 at Castle AFB for the B-52 and KC-135. In each case, the mission of the OES was to uncover operational deficiencies which had not shown up during development testing. Each new OES was formed using a nucleus of experienced personnel from a former OES(1).

A Permanent Function

The sixties saw new engineering sections formed for the B-58, the Minuteman II, the SR-71, and the FB-111 as each of these systems came into the SAC inventory. A major problem in building a new OES was finding available experienced engineering talent. After the early operational problems were solved for the SR-71 and FB-111, both those engineering sections were merged into a permanent SAC Aircraft Engineering Division on the SAC/DM staff, to avoid the phase-out/phase-in problem that temporary OESs had faced. The mission then changed to one of providing continuous engineering support for technical deficiencies encountered in any SAC aircraft. The organization found its niche by not trying to duplicate either the day-to-day maintenance capability for the base

maintenance activities, or the in-depth engineering expertise of AFLC. Instead it concentrated on those in-between problems that were beyond organization or intermediate level maintenance capability, and yet, for one reason or another, were not being addressed by depot.

Current Operations and Emphasis

In the seventies reliability and maintainability problems of the aging B-52 fleet received the lion's share of the engineer's attention. In the eighties SAC is adding the E-4B and KC-10A to its ramps, and once again has to address the unique supportability problems that arise with any new aircraft when it first sees operational use. So the venerable B-52 will have to share the engineer's center stage with the infant E-4B and KC-10A, but in each case the modus operandi remains the same. As materiel problems arise in the field, they are funnelled to the engineering division. There, they are either worked in-house, or the engineer assigned confers with his ALC counterpart to determine whether AFLC will pick it up in total, or make it a cooperative SAC/AFLC project. The AFLC-SAC interface is often the B-52 or KC-135 Product Improvement Working Groups operating under AFR 66-30. In those synergistic groups, the ALC engineers provide the in-depth expertise and analysis with SAC engineers providing service tests and other data from the operational fleet. A multitude of lower level problems that otherwise would never have been resolved have been put to bed through the initiative of those cooperative groups. Log Command is primarily an industrially oriented organization, geared to maximum production at the lowest cost. SAC's primary orientation is to its strategic deterrent mission, to maximize readiness at minimum cost. Loggie engineers think of production, of depot maintenance flow and of MDC reliability data; SAC engineers think of readiness, of OMS launching today's flyers and of monthly abort rates. Those viewpoints are not at cross purposes, they are complementary, and by regularly getting both command's engineers across the table to hammer out solutions, ways are found to achieve the desired end that wouldn't be possible without their mutual trust and appreciation for the other fellow's viewpoints and limitations.

About fifty percent of the SAC engineer's time is spent on joint AFLC/SAC items of interest. The other fifty percent is taken up with in-house SAC projects to meet a particular need that can't be satisfied by the existing acquisition and modification systems. A prime example is jet engine performance trending and condition monitoring. Airline experience in the early seventies proved the value of engine trending in finding sick engines with incipient hot-section failures before they became in-flight incidents. When flagged by a deteriorating trendline, prompt troubleshooting and replacement of deteriorating parts were saving millions of dollars monthly for the airlines. Replacing damaged parts before they fail completely prevents secondary damage of the engine. There were several military study programs looking at engine condition monitoring for the new generation of engines, but operational use of these programs was many years away. SAC's Aircraft Engineering Division studied airline operation and use of engine trending and modified the airline program to account for the differences between SAC and the airlines in the way engines are operated and maintained(2). They tested their version of engine monitoring on four wings of KC-135 tankers from October 1974 through March 1976, adjusted it based on the results of the very successful test, and then over two years phased it into use on all SAC KC-135 and B-52 aircraft(4). The end result was that SAC had over 6000 engines in a successful monitoring program while the rest of the military had only R&D efforts going(3).

Another example of their responsiveness to today's need arose in February 1978 when a SAC bomber on alert was entered and vandalized, despite the security systems and procedures in effect in the alert area. It pointed up a need for an additional burglar alarm type security system on each alert aircraft bomb bay and cockpit. As nuclear weapons security was involved, the need was immediate, so the SAC aircraft engineers were given the job. An aircraft intrusion detector system was designed, prototyped and tested. Parts were then procured and kits assembled and shipped for a Class I modification. All this was accomplished within three months after the incident at a cost for the whole B-52 fleet of under $75,000(5).

There are currently 37 engineering projects in work. These include such diverse areas as: correction of plummeting reliability of B-52 fuel flow flashers, B-5 maintenance stand modification for better gun turret work accessibility, service tests of solid state replacements for tube-type electronics modules, design and manufacture of a hard-copy recorder of radar altitude on low level bombing runs, better interpretation and use of engine trim data, and use of hot water for deicing aircraft. All of their projects are directed at making some contribution to SAC weapons systems or support equipment. They make them either fly better, break less often, easier to fix, safer or more secure. In the course of the ten years of existence as the Aircraft Engineering Division, these SAC engineers have done some 400 individual engineering projects. They've improved the lot of the maintenance man in the field, helped him do more maintenance with less resources, and helped keep the aging SAC fleet mission capable despite the supportability problems created by antiquated systems.

If you'd like to learn more details of their current projects, write or call HQ SAC/LGME, Offutt AFB NE 68113, Autovon 271-4591 and ask for a copy of their current Quarterly Progress Report. Or better yet, next time you stop at Offutt, drop in at Building 41 and see for yourself the SAC version of "do-it-yourself" in logistics engineering.

References

(1) Paul, Major, "Strategic Air Command Operational Engineering Program," SAC/OIH, 26 May 1975.

(2) Pettigrew, Lieutenant Colonel James, "Engine In-Flight Monitoring," *Combat Crew*, July 1976.

(3) ________ , and McCord, Chief Master Sergeant Robert, "Propulsion Reliability Improvement Through In-Flight Performance Monitoring," *Combat Crew*, January 1977.

(4) SAC Regulation 66-22, 26 October 1978.

(5) SAC Pamphlet 207-8, "Alert B-52 Aircraft Intrusion Detector," 28 April 1978.

Development of the Centralized Aircraft Support System

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A centralized system designed to save money, increase mission efficiency, and improve the environment has proven extremely successful in a test program conducted at Randolph Air Force Base, Texas. The system, referred to as CASS or the Centralized Aircraft Support System, is used for T-38 aircraft and supplies low pressure, high volume air for aircraft starting; utility air for hand-operated, air-driven tools; 115 VAC, 400 Hz electrical power for use with aircraft electrical systems and test equipment; and 115 VAC 60 Hz power for electrically operated hand tools and test equipment. The major equipment components of CASS are centrally located with air and electrical power distributed through underground manifolds to stations located on the aircraft ramp.

Testing the Concept

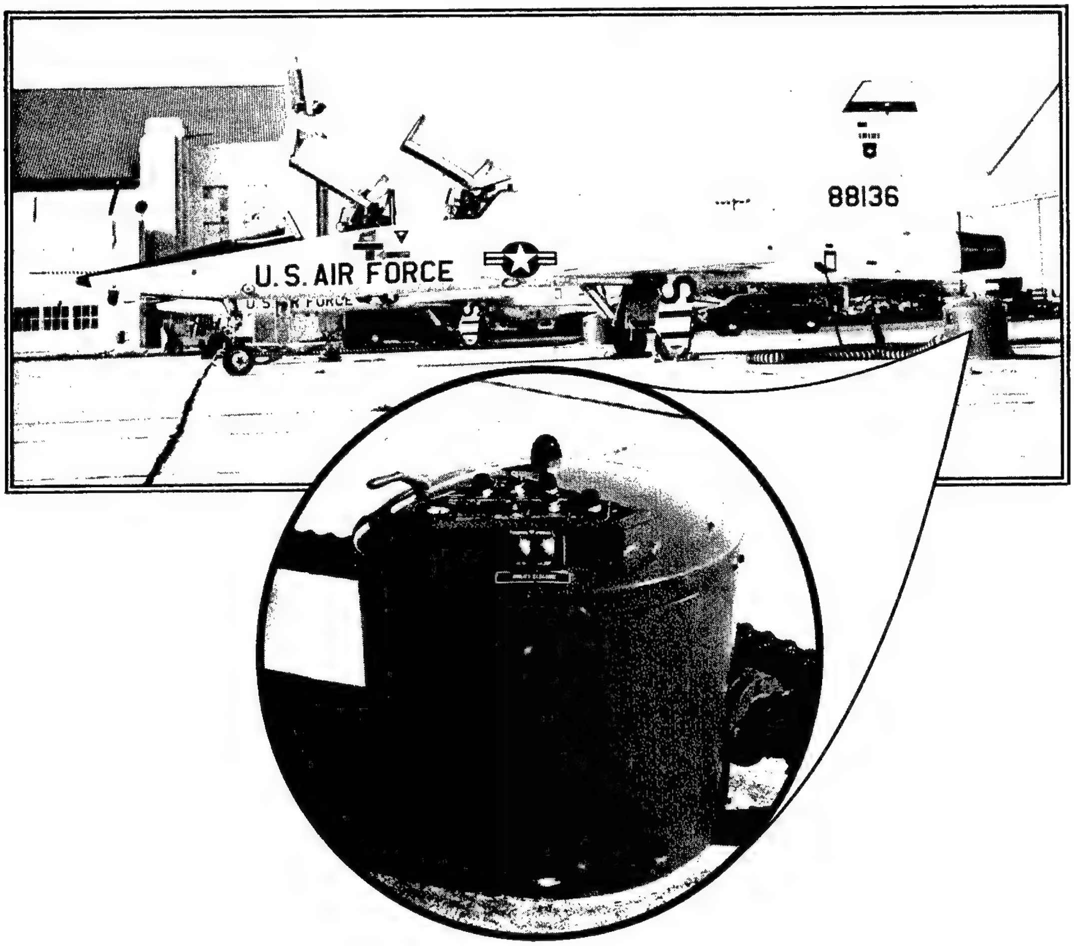
This concept, which was originally presented by representatives of the Hyfore Manufacturing Corporation, was briefed to ATC in May 1975. ATC saw a definite need for the system and arranged to test and analyze it before complete implementation. As a result of the request for proposals, Value Engineering (today known as Value Systems Engineering) was awarded the contract for the design of the CASS project. The Productivity, Reliability, Availability, Maintainability (PRAM) Office, the Air Force's funding source for experimental projects, was contacted and a test CASS was funded for 18 below ground stations. After the system was built, a six-month test of 36 aircraft using CASS versus 36 aircraft using standard support equipment was implemented in May 1978, with each of the 18 CASS islands supporting two T-38 aircraft. The cost effectiveness of operating and maintaining each type of system was analyzed by comparing materials, labor and electricity/fuel. In all areas, standard support equipment costs greatly exceeded the cost associated with CASS. The only major problems with CASS discovered during the test program were due to the below ground island design. These included problems with air-operated piston type sump pumps used to free the pits of liquids; electrically operated air solenoid valves used to control the air upon engine start and vent air from the line following system operations; and, transvectors used to evacuate fuel vapors which constantly leached air off of the system.

The Above Ground Station Solution

As an alternative after the six-month test was completed, an above ground station was designed which does not increase operational hazards and at the same time upgrades the maintainability and reliability of the servicing stations. The improved above ground servicing island is designed in a cylindrical shape 30 inches high and 30 inches in diameter. It reduces the overall procurement cost of the CASS by 20 percent and reduces maintenance costs by approximately 90 percent. But, most importantly, it provides the reliability necessary for implementation of CASS throughout the Air Training Command within the next four years. At the present time, three above ground servicing islands have been installed and are being tested at Randolph AFB Texas. The servicing

Table 1. Cost Analysis of CASS versus Standard Support Equipment

	Standard Support Equipment	CASS	Savings
Implementation Costs			
Support Equipment Replacement	$15,019,956		
Randolph CASS Project		$ 773,500	
ATC CASS Installation		10,800,000	
Implementation Savings			$ 3,446,456
Operation & Support Costs			
1st 5 years	16,625,000	2,123,565	14,501,435
Life Cycle (25 years)	83,125,000	10,617,825	72,507,175
Net Savings with CASS			
1st 5 years			17,947,891
Life Cycle (25 years)			75,953,631



islands have proved highly effective in meeting flightline demands and are proceeding without problems.

CASS was an innovative approach to replace ATC's outdated support equipment. The previous method of supplying ground support for T-38 aircraft was through the use of support equipment which required continuous servicing, inspection and repair and had to be continuously towed around the flightline area to wherever it was needed. With the end of the 20-year life cycle rapidly approaching, the only available replacement for the MA-1A air compressor was the A/M 32A-60A gas turbine generator. The high cost and over design of the replacement unit for use on the T-38s in ATC prompted the search for an alternative. After testing and evaluation, CASS proved to be that alternative.

Results

Results from the study reveal that CASS will save ATC $75 million over a 25-year life cycle with a total payback of three and a half years (see Table 1). The six-month test reveals significant environmental savings as well. For example, CASS helps eliminate the high noise level produced by power support equipment, reduces air pollutants generated by the mobile support equipment, and limits the number of tow vehicles. The new system also reduces consumption of natural resources. The powered aircraft support equipment requires petroleum products; the CASS operates on efficiently produced commercial electrical power.

Implementation Plans

ATC is currently programming construction of CASS at all flying training bases. Presently, the schedule for CASS installation throughout ATC calls for completion of the Randolph AFB CASS stations in FY 80 followed by installation at Laughlin AFB, Texas and Reese AFB, Texas in FY 81 and ending with Williams AFB, Arizona; Columbus AFB, Mississippi; Vance AFB, Oklahoma; and Sheppard AFB, Texas. Other commands and foreign countries have also expressed an interest in the CASS concept. The system can fulfill many aircraft ground support needs throughout the Air Force at a reduced operating cost. The only areas where benefits will decrease are those in which mobility and flexibility are prime factors. The test system at Randolph AFB provides an excellent working model for determining if other Air Force installations can apply the concept to reduce their aircraft ground support costs.

CASS is managed by the Support Technology Branch, ATC Logistics. Further information can be obtained by calling AUTOVON 487-4546.

A Management Training Seminar Based on a Modified Delphi Survey

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Abstract

In the winter of 1978, a decision was made by the Director of Maintenance of the Oklahoma City Air Logistics Center to build a cooperative management team committing themselves to identifying and solving long-range logistics problems. It was decided to conduct a total immersion working/relaxing seminar for the team building phase. A Delphi survey identified problems which served as the cognitive material to be discussed at the seminar. The Delphi technique, developed by Rand Corporation, is based on a survey format employing multiple rounds with sequential statistical feedback to respondents. During this seminar, the top priority logistics problems were analyzed, and an honest commitment to change for organizational improvement was initiated. Briefly, the top problems addressed were: (1) motivation of workers, (2) declining work quality, (3) supportability-parts, (4) declining productivity, (5) personal responsibility for quality production, (6) loss of pride in workmanship, (7) recruitment, (8) technical training of younger workers, (9) poor channels of communication, and (10) too much paperwork. A Delphi Task Force Committee was established at the conclusion of the seminar to implement some of the suggestions resulting from the problem-discussions.

Purpose

The purpose of this paper is to explain the process of identifying logistics problems using the Delphi technique and the subsequent use of the results to conduct a team building seminar with follow-on participative management.

Background

Logisticians and educators must meet on a common practical ground to economically accomplish mission effectiveness. Through this relationship both can utilize certain tools that effectively accomplish the goals of logistics. One productive and economic tool that can be used cooperatively is the Delphi survey of expert opinion. This technique provides the logisticians with an information base that systematically identifies real logistics problems lurking in the future, while at the same time, allowing educators to increase the amount of student participation in the learning process. As a result, logisticians and educators can be linked by the utilization of a practical and economic research tool.

In the winter of 1978, the Director of Maintenance of the Oklahoma City Air Logistics Center (ALC) decided to build a cooperative management team committed to identifying and solving long-range logistics problems. One way to accomplish this was to conduct a total immersion working/relaxing seminar for the team building phase. Dr. Robert G. Stein, Professor of Logistics, Weber State College, was contacted to organize this seminar. In cooperation with the Weber State Instructional Development staff, a proposal was made to use a modified Delphi survey to identify the problems to be addressed at the seminar. It was modified from the standpoint of surveying all of the top management at the Directorate of Maintenance, Oklahoma City ALC, not by selecting so-called "experts" to respond. The technique proposed was similar to the experience Weber State College had in conducting a survey of its faculty on curricular changes. The proposal was investigated, discussed and approved by the Director of Maintenance and his Training Staff, for use as a technique to integrate the real world of logistics problems with the educational environment of a seminar.

It is appropriate to point out the advantages and disadvantages of this technique. Folk(1) examined the advantages and disadvantages specifically in the light of its most outspoken critic, Sachman(2). Table 1 summarizes their reactions.

In light of the criticisms of the Delphi method, it was felt that there could be considerably more positive potential for identifying logistics problems if used as a general guide for future planning. For as Weaver (3:270) points out, the Delphi technique holds promise as "a planning tool which may aid in probing priorities held by members and constituents of an organization."

Table 1.
Delphi Advantages and Disadvantages

ADVANTAGES	DISADVANTAGES
• Group problem solving using multiple polling	• *Question bias*
• Individual anonymity	• *Ambiguity created by questions*
• Applicable to a wide variety of situations	• *High dropout rate*
• Tends to produce consensus	• *Feedback may unduly cause consensus*
• Statistical responses	• *Statistical limitations for final analysis*
• Simple to plan and administer	• *Unconventional instrument (American Psychological Association)*
• Low cost	• *Difficult to project results to needed programs*
• Easy for respondents to understand	
• Provide base for long-range planning	

Delphi Instrumentation

The problems for study using the Delphi technique were developed from an introductory management seminar conducted with the Maintenance top management. During the seminar, the participants were put into brainstorming groups to generate as many problems as they foresaw within the next five years in the Maintenance Directorate. This information was then transformed into a first round survey instrument of 33 problems. The instrument was then sent to the top management people who generated the problems during the management seminar. Respondents were provided with a description of the survey's purposes, the technique of using multiple rounds, and were asked to make two responses to each problem.

Respondents were first asked to rate the "importance" of the statement on a one to five scale (1 = high, 5 = low) and secondly, using the same scale, to rate the "likelihood of solving in the next five years." Of the 90 sent, 85 were returned, providing 94% return for Round I. Respondents to Rounds I and II were provided with the means ($\bar{x}$) and the standard deviations (Sd) for each item when they were asked to respond to the next round so that they could observe how their colleagues responded.

Results

At this point, as in other Delphi studies, judgments on the part of the investigators tend to create variance. Decisions had to be made regarding which problem areas were to be given priority for discussion at the follow-up seminar. Does one use the rank order of discrepancy or rank order of importance? Table 2 shows the ten items which created the greatest differences in mean value between "importance" and "likelihood."

Table 2.
Greatest Difference Between Importance and Likelihood (Pessimism)

RANK	PROBLEM	DIFF A-B
* 1	Supportability/parts	2.09
* 2	Motivation of Workers (Productivity and Quality)	1.90
3	Unwieldy personnel promotion system	1.76
* 4	Too much paperwork for supervisors	1.70
* 5	Declining work quality	1.69
* 6	Loss of pride in workmanship	1.68
* 7	Declining productivity	1.66
* 8	Recruitment	1.61
* 9	Personal responsibility for quality production	1.55
*10	Poor channels of communications	1.39

*Also on Most Important List

This condition might lead one to believe that the respondents were very pessimistic in their perceptions of future achievements. All but one of these items ranked in the top ten problem areas in "importance," as listed in Table 3. It is also noted in Table 3 that eight of the most important problems were also the highest on agreement of importance; i.e., the lowest standard deviation.

Table 3.
Most Important Problems

RANK	PROBLEM	MEAN
1	Motivation of workers (Productivity and Quality)	*4.52
2	Declining work quality	*4.47
3	Supportability/parts	*4.41
4	Declining productivity	*4.34
5	Personal responsibility for quality production	*4.32
6	Loss of pride in workmanship	*4.24
7	Recruitment	*4.15
8	Technical training of younger workers	4.09
9	Poor channels of communications	*4.02
10	Too much paperwork for supervisors	3.95

*Low Standard Deviation - High Agreement

Table 4 highlights the top ten most likely solvable problems with only one on that list also on the top importance list. The group seemed to be relatively optimistic concerning these problems.

Table 4.
Greatest Likelihood of Solving (Optimism)

RANK	PROBLEM	MEAN
1	Ineffective women and minority programs	3.43
2	Lack of management-development programs	3.37
3	Poor management-union relations	3.20
4	Poor customer relations	3.18
5	Lack of direction/goals	3.12
6	Lack of supervisor technical competence	3.10
7	Poor technical skills of workforce	3.08
*8	Technical training of younger workers	3.06
9	Mistrust in communications	3.03
10	Lack of cohesiveness (common goal)	2.93

*Also Top Importance

In summary, respondents showed considerable agreement among their perceived discrepancies between importance and likelihood, agreement of importance, and overall importance. Therefore, it was determined that the problems of focus for the follow-up seminar would be taken from the items ranked highest in importance.

The Delphi Management Training Seminar

A follow-up seminar was conducted in December 1978 after an analysis of the results of the three rounds of the Delphi. The approach was to allow for a total immersion working/relaxing seminar to provide for the following:

- To get away from the day-to-day routine environment.

- Allow for maximum individual participation.

- Encourage honest, open, supportive discussion along with new ideas and possible solutions to problems.

- Provide opportunity so that participants would get to know each other better on a more informal relaxed basis.

- Provide a positive environment for personal growth and motivation.

The objectives of the seminar were discussed and furnished to all participants and were as follows:

1. Build a cooperative management team.

2. Generate solutions to possible future logistics problems.

3. Lay groundwork to establish objectives for the Directorate of Maintenance at the Oklahoma City ALC for the next one to five years.

4. Develop honest commitment to organizational change and improvement.

It was decided to use the local Tinker AFB Officers' Club as an appropriate setting for the seminar. It was far enough away from the routine organizational environment to prevent constant interruptions, yet close enough to allow for emergency interruptions.

Those who participated in the Delphi survey also participated in the seminar. The seminar participants were arranged in groups of five individuals at round tables to facilitate maximum participation. Each group was prearranged to provide for heterogeneous grouping of participants; i.e., military-civilian, sex, age, and job specialty. Tables 5-7 provide a breakdown of the ranks and key job positions of the participants:

After a short presentation of the Delphi results, each group was given a different problem to analyze and generate solutions. The junior member of each group was asked to summarize the group's solution for the total seminar participants upon completion of their discussion. This provided a motivational growth experience for the young logisticians involved in the task group while at the same time it served to neutralize any possible cynicism present during group discussions.

The major problem areas discussed were those as listed in Table 3. Although a scientific post-session critique was not made, a general meeting was held to discuss subjective feelings. Continual evaluation and feedback is necessary to insure long term accomplishment of objectives. This should take the form of letters, reports, and follow-on seminar. The follow-on seminar should be similar in terms of format, but should emphasize progress toward accomplishing the objectives, appropriateness of the established objectives, with additional objectives proposed. A working management by objectives (MBO) seminar was scheduled to follow-up on proposed solutions. A Delphi Task Force was established to provide a link between the seminar and the realities of the everyday work environment.

Delphi Task Force

At the completion of the seminar, volunteers were recruited to serve on a Delphi Task Force. Their main objective would be to work on the suggested solutions arrived at during the seminar. The Director of Maintenance chose seven volunteers from a list of 35 names. The fact that almost half of the seminar participants volunteered to serve on the Task Force indicated that there was great interest generated to accomplish change within the organization.

A meeting was held with the Task Force immediately after the seminar. The Director, along with the seminar facilitator, outlined top management support and overall guidelines, respectively. The following guidelines were discussed and agreed upon by Task Force members:

1. Accomplish the following primary duties:
   - Fact finding
   - Problem solution development
   - Recommendations

2. Hold short weekly meetings.

3. Take the easiest problem/solution to implement first.

4. Gain involvement and consensus with affected

Continued on page 32

Table 5.
Number of Civilian Participants by Grade

General Schedule Grade	Number
GS15	1
GS14	5
GS13	18
GS12	13
GS11	5
GS09	5
Ph. D. Professor (Visitor)	1
Total	48

Table 6.
Number of Military Participants by Rank

Rank	Number
Colonel	5
Lt Col	2
Major	2
Captain	3
Total	12

Table 7.
Number of Participants by Job

Job	Number
Director of Maintenance	1
Chiefs of Divisions	6
Deputy Chiefs of Divisions	6
Chiefs of Branches	20
Deputy Chiefs of Branches	3
Training Specialists	3
On-the-Job Enrichment Spec.	6
Other	14
Total	60

LOGAIR Mark 2: An Alternative Logistics Airlift System

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INTRODUCTION

Statement of Problem

From 1954 to the present, the Air Force has used a domestic airlift system known as LOGAIR to provide expedited logistics support between depots and bases (5:16). LOGAIR was founded on a basic logistics premise, namely that "the use of airlift will cut the pipeline time of high cost items" (5:9). Using contractor owned and operated aircraft, LOGAIR continues to play a major role in the transportation of weapon systems spares to and from bases throughout the CONUS.

Two major trends have developed which indicate the need for re-evaluation of the present domestic airlift concept. First, as airline small package services and air freight forwarders have focused more attention on the market, overnight service quickly has become the standard for expedited shipments. LOGAIR, which claims an average of 2.5 days transit time for the highest priority, Mission Capability (MICAP/formerly NORS) shipments (1), in the author's opinion, simply cannot compete under the increasing pressure to "get it here yesterday!" While still a major mode of shipment for MICAP shipments (approximately 14 percent of LOGAIR traffic) (9:12), LOGAIR is increasingly being regarded (and used) as a routine mode of transportation, primarily for reparables and stock replenishment items. The MICAP items that affect major weapon systems readiness are increasingly moving by other modes which can provide the single most important requirement—speed.

The second major trend—toward reduced readiness—is a result of many complex factors, but is also a by-product of the combined effect of high cost spare parts, limited War Readiness Spares Kits (WRSK), reduced budgeting for spares and the growing complexity of weapon systems. Serious investigation is needed of alternatives to the current LOGAIR system which might better support the flow of repair cycle items and provide improved service for the critical spares affecting immediate readiness. Such an investigation was made by the author at Air Command and Staff College in 1978-79.

Objectives of the Study

The overall objective of the study (of which this article is a condensation) was to design and evaluate an alternative concept for the domestic airlift support of Air Force activities. This alternative, called the LOGAIR Mark 2 (Mk 2) system, represents the adherence to certain of the basic attributes of the existing LOGAIR system while incorporating a totally different route structure concept.

The operational goal for the Mk 2 system was a reduction in the transportation portion of the logistics pipeline. This reduction, if realized, would directlyimpact on the readiness posture of all Air Force activities.

Limitations and Constraints

A major, self-imposed limitation was the non-use of computer models for the optimization of the Mk 2 system. The simplified model route structure as presented is intended only as a working example of the concept and not a finite solution.

The development of this study while the Fiscal Year (FY) 1979 and future LOGAIR programs were undergoing significant changes as a result of Congressional "interest" (15 and 16) presented some problems. The last minute nature of the appropriations decisions and subsequent reductions in LOGAIR service for FY 1979 placed this paper against a background of a certain amount of upheaval. As a result, data for FY 1978 was used for many of the comparisons rather than the more recent but somewhat distorted FY 1979 figures. The study first analyzed in detail the existing LOGAIR system and a successful alternative concept then applied the alternative concept to Air Force needs and analyzed the results. This article is organized accordingly.

THE LOGAIR SYSTEM

In FY 1978, LOGAIR provided daily, seven day-a-week service to 58 Air Force installations and five day-a-week service to the two Navy installations on the route structure shown on Figure 1. Each day, the AFLC ALCs and the individual bases are provided allocations for inbound and outbound tonnage based on previously requested requirements (bases) and output schedules (ALCs).

Under the current system, there are four hubs: Hill, Kelly, Robins and Wright-Patterson AFBs. Each of the four hubs with the exception of Kelly originates two feeder flights providing service to the MAJCOM's first line weapons systems. Kelly originates one feeder flight.

Although the number of bases receiving direct, "on-line" service (aircraft landing at that base) has been gradually reduced over the period of the late 1960s, a large number of bases and other activities receive "off-line" service, normally truck delivery from an on-line station. This service is used for nearby bases as well as small users of LOGAIR whose level of shipments does not warrant direct service. Off-line service is also provided to DOD contractors and other services and DOD activities. A total of 908 off-line points, from Aberdeen Proving Ground to Zaneville, Ohio receive some form of off-line LOGAIR service (10:29-84).

Cargo Priorities

As an air mode of transportation, LOGAIR is normally used only for high priority cargo shipments. Within the DOD, both supply priorities and the corresponding transportation priorities are a function of the combination of the mission of the unit requisitioning the item and the urgency of need for the item (3:1-10). The focus of this study was on those items with air eligible priorities, i.e., Transportation Priority 1 (TP-1) and Transportation Priority 2 (TP-2). Although 999/MICAP designations are actually part of the TP-1 grouping of supply Priority Designators, they do, as a group, receive by regulation or convention, expedited handling as a "Super TP-1." The 999 designation usually applies to shipments for overseas units while MICAP (formerly NORS) is normally used for similar critical CONUS shipments. Table 1 summarizes recent AFLC transit time experience. Note that the TP-1 data includes the MICAP figures and reflects the weighted average of both MICAP and non-MICAP TP-1 shipments.

Table 1.
Average Transit Time-LOGAIR Shipments (1)

Transportation Priority	Average Transit Time (days)
MICAP	2.5
TP-1	3.2
TP-2	3.5

Similar data for transit times for shipments from ALCs to SAC bases over a six-month period parallel the total AFLC experience. The SAC experience (to 25 CONUS bases totaling over 40,000 TP-1 shipments) was an average of 2.6 days for MICAP items and 3.3 days for TP-1. The format in which the SAC data was available permitted the "extraction" of the MICAP figures from the TP-1 total and indicated that the non-MICAP TP-1 items averaged 3.6 days in the transportation system (13). In addition to the transportation and terminal hold/transit time, total pipeline time includes supply actions, passing action, and inventory control point availability determination. For TP-1 shipments, the DOD standard for total pipeline time is seven days, of which three days is allowed for transit time; for TP-2 items, the standard is 11 days with six days for transportation. Based on the AFLC data shown in Table 1 and the corresponding SAC data, MICAP shipments by LOGAIR meet the three day standard for transit time while TP-1 shipments overall, and non-MICAP shipments specifically, exceed the DOD standard (3).

Overall, LOGAIR represents the major mode of high priority shipments from ALCs to user bases as well as providing rapid return of reparables to the ALCs and other repair facilities (9:17). LOGAIR's multiple hub operation, however, is not the only concept on which to build a complex route structure. In fact, an alternative used by the Federal Express Corporation (FEC) has been highly effective.

THE FEDERAL EXPRESS CORPORATION EXPERIENCE

The essence of the FEC concept is a single hub of operations located in Memphis, Tennessee. Memphis was selected due to its excellent flying weather and proximity to the "center of gravity of package movements" (6:2).

Each weekday, the FEC aircraft leave their "home" cities, sometimes making enroute stops, and fly to Memphis. At the Memphis terminal, all packages are offloaded, sorted and reloaded on the aircraft which depart early the next morning. To insure optimum payload utilization of the aircraft, packages are limited to 70 pounds and a maximum length plus girth of 108 inches. In focusing on this small package market, FEC drew heavily on the experience (and personnel) of the United Parcel Service (UPS) (6:3).

Federal Express began common carrier service to 22 cities on April 17, 1973 with a fleet of ten Falcons and 150 employees (6:3). As of December 1978, Federal Express service had further expanded to serve 97 cities directly by air, over 8,000 by truck (19:6) and the daily volume had grown to over 57,000 packages (including Courier Pacs) (4). At an average weight of 12 pounds per package, this daily workload totals 342 tons per day processed through the hub terminal facility at Memphis (4).

Probably the most important conceptual point regarding the tremendous expansion and growth of Federal Express is that early plans to operate regional sub-systems with mini-hub terminals to cope with the expanded volume (2:71) have been abandoned in favor of continued expansion of centralized operations at Memphis (4).

Overnight service, which forms the bulk of the FEC traffic (6:27), is provided by operating a central terminal facility with all cargo flowing into and out of that location every day. Based on its significant growth, expansion of service, and over six years of successful operation, FEC has clearly demonstrated the operational and economic validity of the single hub, high speed air freight concept.

THE LOGAIR MARK 2 SYSTEM

Design Concept

Having reviewed the present LOGAIR and Federal Express Corporation operations, the possibility of combining the FEC single hub concept with the requirements presently handled by LOGAIR will be explored in depth.

A number of studies (18) have previously addressed the design of the LOGAIR route structure but have generally limited their scope to the optimization of the present structure or trade-offs with other modes. The single hub system presented in this paper as LOGAIR Mk 2 is developed in detail to demonstrate the feasibility of the concept as applied to the Air Force logistics environment and draws heavily on the existing system in order to provide a common measure of comparability.

Assumptions

In order to simplify the design of a completely new route structure, several key assumptions were made.

Assumption 1—Level of Service: Daily (seven days per week) service to all stations served by the Mk 2 system is assumed.

Assumption 2—Traffic Requirements: The base-line used for the daily tonnage requirements for the Mk 2 model was the actual LOGAIR requirements forecast for FY 1979 as submitted by the user stations in the spring of 1978 and summarized by AFLC in an origin/destination matrix (11). Daily workload figures (obtained by dividing the annual requirements by 365) are used in this study rather than annual data in order to improve the visualization of the requirements and simplify data handling. To improve the comparability to the FY 1978 system and to accommodate the single hub concept itself, several minor modifications to the annual requirements were necessary (such as the deletion of tonnage between a few closely located bases from the data based on the assumption it would move via surface transportation). In general, the requirements used to develop the Mk 2 system are identical to the requirements used by HQ AFLC in the development of the actual FY 1979 LOGAIR system prior to the cut backs in that year's operation.

Assumption 3—Central Hub Location: The choice of Tinker AFB as the hub terminal location for the Mk 2 system represents the result of both a detailed "center of gravity" analysis as well as common sense factors. Using a ton-mile center technique described by Smykay, Bowersox and Mossman (7:180), and applying the FY 1979 requirements, the ton-mile center of the system was found to be approximately 140 miles directly north of Tinker AFB, near McConnell AFB, Kansas. While this calculation indicates the ideal central point, i.e., the point at which total ton-miles would be the absolute minimum, the fact that Tinker is a major Air Logistics Center (ALC) and has somewhat better weather makes it a more logical choice for a central hub terminal.

Assumption 4—Types of Aircraft: In order to provide as much comparability as possible, the aircraft selected for the model for the Mk 2 concept are the same as those presently used by LOGAIR: the Lockheed L-188 (Electra) and L-100 (Super

LOGAIR FY 78 Route Structure

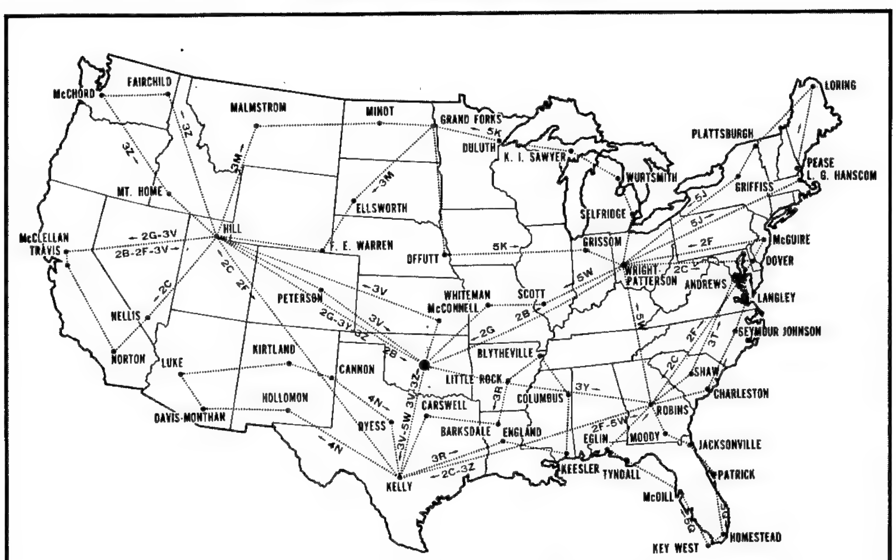

Figure 1.

Hercules). The DC-9 aircraft was omitted. Only one DC-9 was used in the FY 1978 system (Route 4N) (10:7) and the contract cost for the DC-9 is the same as the L-188 (9:62).

Assumption 5—Aircraft Payloads: The LOGAIR minimum aircraft payloads (34,000 pounds for the L-188 and 46,000 pounds for the L-100) are used as the basis for the calculation of payloads used in the design of the Mk 2 route structure. From these gross payloads, the weight of pallets and nets used to carry and secure the cargo was subtracted to obtain a maximum *cargo* payload for each aircraft.

Assumption 6—Central Hub Terminal: For the purpose of analysis, it was necessary to assume that a terminal facility capable of handling the workload generated by the Mk 2 system would be located at Tinker AFB. While it is outside the scope of this paper to present technical arguments for automated and mechanized materials handling equipment, it is clearly possible to build and operate such a terminal.

Assumption 7—Aircraft Flying Times: In order to develop a flight schedule of the Mk 2 model, it was necessary to estimate block-to-block flying times for the various route segments. A single set of average speeds was applied to various distances, regardless of the aircraft type, as follows: For routes of less than 100 miles—30 minutes; routes 101 to 300 miles—230 miles per hour; longer than 300 miles—280 miles per hour. While not incorporating the many complex factors normally associated with flight planning, the resulting times and schedules are quite close to the actual schedules flown in FY 1978.

Assumption 8—Aircraft Ground Times: Feeder stations were given a 30 minute ground time; feeder stations with a fueling stop, 45 minutes; APOEs, 45 minutes; and the ALCs and Wright-Patterson AFB, 60 minutes. These times are roughly equivalent to the actual LOGAIR times.

Design Methodology

Since daily service to all stations was assumed and the tonnages fixed, the design of the route structure became a series of iterations to provide the best level of service at a minimum cost. The assumptions regarding types of aircraft and payload placed reasonable limits on the possible number of variables and outcomes. Essentially, the design methodology amounted to selecting an aircraft type, "flying" it through a tentative route and making successive adjustments as required.

While the feeder stations require only one flight per day, the ALCs and some APOEs require multiple flights to handle the tonnage requirements. For this extensive ALC/APOE traffic, a separate analysis was performed to determine if ALC to ALC/APOE traffic would warrant use of routes linking them directly, i.e., by-passing the hub. It does not. The system was more effective when all traffic, including the large tonnages from/to ALCs/APOEs, moved into and out of the central hub.

The end product of the design methodology is a total system made up of individual route segments and represents a departure point for further refinement. Four complete route structures were developed and tested for this study, of which only the least cost alternative, the LOGAIR Mk 2 system, will be described in detail.

Description of the Mk 2 System

The final version of the single hub concept applied to the Air Force requirements is shown on the map at Figure 2. A total of 16 route segments, ALPHA through PAPA, provides daily service to the 58 stations shown plus Tinker AFB as the hub location (FY 78 bases less McConnell).

The route patterns are divided essentially into trunk routes serving ALCs and APOEs, and the feeder routes serving the user bases. In some cases, the routes may include both ALCs/APOEs and user bases.

As is evident from the route map, the route patterns follow an out and back path from/to Tinker AFB as the center of the system. It is important to re-emphasize that all cargo to the bases originates at Tinker each day and all cargo from the bases and ALCs or APOEs terminates at Tinker.

System Performance

Flight Schedule. In order to provide some measure of performance, an actual flight schedule was developed, using the route patterns shown in Figure 2. In general, all flights but six departed from Feeder stations during normal duty hours (0800-1700) and only two ALCs required loading crews over more than a nine hour shift.

A key factor in the success of the central hub concept is the ability to accomplish the large sorting process. In the Mk 2 system most flights (12 of 16) terminate by 0300Z and all flights are scheduled in by 0445Z. Similarly, the first flight each day departs at 0940Z with the bulk of flights (14 of 16) departing after 1000Z. The absolute minimum time for connection between flights is just under five hours. The required level of workload (unload and load 32 aircraft in a period of 21 hours from first landing to last take-off) is both feasible and realistic, particularly in the light of the Federal Express experience. FEC handles roughly 340 tons and 57,000 pieces daily through their facility in Memphis (4). The Mk 2 system would require handling approximately 300 tons per day but less than 6,500 pieces (14). The average weight of shipments—12 pounds each for FEC (4) and 94 pounds for LOGAIR (14)—indicates that the automated material handling equipment in the Tinker facility would need to be of somewhat greater handling capacity but not require extraordinary speed of handling.

Transit Time. In measuring the "performance" of the Mk 2 system, a multi-step process was followed to provide overall estimates of expected transit time. Transit time, as used in the study, is measured from the time the shipment is presented at the origin air freight terminal to the time of arrival at the destination air freight terminal and includes both terminal holding time as well as actual flying time.

For this study, a maximum (worst case) and minimum (best case) hold time was identified. The maximum hold time occurred when the shipment was turned in at the origin terminal just as the last flight (or only flight) was leaving, and the hold time is measured from the departure time of the last flight to the departure time of the first flight the next day. For a minimum hold time at origin, the shipment is assumed to be turned over to the air terminal three hours prior to departure of the last flight of that day. For Tinker ALC shipments, the origin hold time is zero and reflected in the hub terminal facility hold time. Hub terminal hold time was measured from the arrival of the aircraft to an arbitrary cut off time of 2400Z. This enabled all subsequent estimates of transit time to be calculated from a common base. Arrivals after 2400Z are reflected as negative numbers.

When the three portions of the transit time are added together, they form the baseline for the addition of individual flights times to obtain an expected total transit time. Table 2 presents a sub-total of transit time measured up to 2400Z at the hub terminal. This sub-total, when shown as a negative number, indicates that in that particular case, the shipment originated at the ALC after the 2400Z cut off time.

The final portion of the overall transit time is measured from 0000Z to scheduled arrival at each destination. Based on the scheduled arrival times at each feeder station and APOE, the average arrival time was calculated to be approximately 1900Z. Based on this average arrival, 19 hours will be used as a simple illustrative figure for the final portion of the transit time in some of the calculations below. Later calculations will use specific figures for selected bases.

As an indication of the overall performance of the Mk 2 system, the expected total transit time can be estimated by adding the 19 hour final portion to the previously calculated sub-total for each ALC. Table 3 represents the addition of 19 hours to each of the sub-totals in Table 2 and a conversion from hours to days.

Table 2.
Subtotal Transit Time (Hours)

	McClellan	Hill	Tinker	Robins	Kelly
Maximum/Worst Case					
Origin Terminal Hold	19	12	0	18	14
Flight Time From ALC	5	3	0	3	2
Hub Terminal Hold	2	7	10	7	10
Subtotal	26	22	10	28	26
Minimum/Best Case					
Origin Terminal Hold.	3	3	0	3	3
Flight Time From ALC	5	3	0	3	2
Hub Terminal Hold	-3	-5	-7	0	-1
Subtotal	5	1	-7	6	4

Table 3.
Expected Average Transit Time (Days)
(From ALCs to all bases)

	McClellan	Hill	Tinker	Robins	Kelly
Maximum	1.9	1.7	1.2	2.0	1.9
Minimum	1.0	0.8	0.5	1.0	1.0

LOGAIR Mk 2 Route Structure

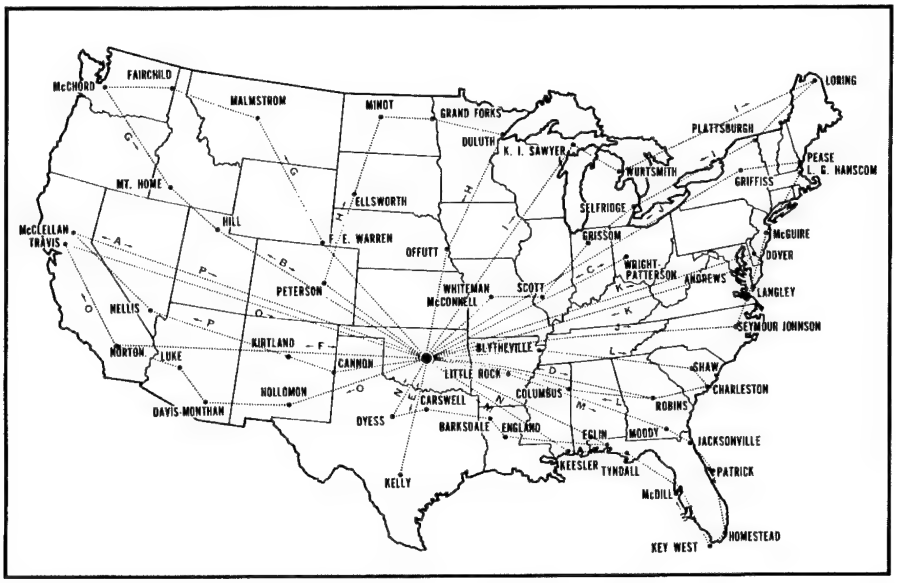

Figure 2.

Using a simple (unweighted) average of the expected transit times from each of the ALCs, an overall average transit time of 1.7 days (maximum case) or 0.9 days (minimum case) can be expected for the LOGAIR Mk 2 system.

Recognizing the inherent problems with values based on simple averages, and that the figures of 1.7 and 0.9 days do not take into consideration the significant differences in ALC originating tonnages, a further examination of transit times was undertaken, using specific bases as examples. The three bases used were selected for their representative transit time experience from a total of 20 SAC bases for which detailed actual transit time data was analyzed.

Table 4.
Expected Transit Time for ALC Shipments (Days)

	Maximum	Minimum
Fairchild	1.6	0.8
Plattsburgh	1.7	0.9
Barksdale	1.5	0.7

The times in Table 4 represent the expected transit time for a shipment from any ALC via the Mk 2 system and reflect the weighting of more frequent shipments from the ALCs at Tinker, Kelly, and Robins. Note that the range of expected transit times based on specific bases is similar to the results obtained using overall averages.

ANALYSIS AND EVALUATION OF THE MK 2 LOGAIR SYSTEM

Type of Service

By design, the Mk 2 system provides a virtually identical type of service as the existing system. From the viewpoint of the feeder stations, there would be little change in the manner in which they shipped and received cargo. While not retaining the apparent flexibility of the current system for rerouting in support of moving MICAP items, the Mk 2 system, overall, would be significantly faster and would probably eliminate the need to use costly commercial transportation for critical items.

The ALCs would, however, find a much different LOGAIR environment. The tasks at the ALC air terminals would be greatly simplified since all cargo originating at the ALC would be for only one destination—the hub terminal. Similarly, all cargo received would be for local consumption or forwarding to off-line stations. This simplified air terminal workload would permit major reductions in the work force, particularly in the cargo processing and aircraft loading crews. Another possible "side-effect" of the single destination operation at ALCs could be an increase in utilization of the cargo pallets since they could be built without regard to the ultimate destination of the cargo.

First-in-first-out (FIFO) processing would be needed at the ALC terminals (and the hub) as well as procedural changes in the method of allocating payload to the various downline stations.

Cost Comparison

Based on the contract rates for miles/landings applied to the Mk 2 route structure the annual operating cost of $59.3 million (in Table 5) represents an increase of approximately 19 percent over the cost of the FY 1978 contract. The overriding difference in cost of the two systems results from the total miles flown (15.2 million for Mk 2 and 13.4 million for the FY 1978 system). This element essentially accounts for the total cost difference and is a reflection of the necessity to fly longer routes to support the central hub concept; 4.9 million gallons of fuel would be required to operate the additional 1.8 million miles.

While the construction of terminal facilities able to handle the increased cargo at the hub would involve significant capital investment, it is anticipated that overall savings in inventory/pipeline costs during the first year of operation of the Mk2 system should offset this initial expense.

Performance

Of the many factors to be considered, the performance of the Mk 2 LOGAIR system provides the most interesting comparison to the present LOGAIR system.

An overall average transit time of 1.7 days (maximum/worst case) and 0.9 days (minimum/best case) was attributed to the Mk 2 system for shipments from ALCs to bases. Using a weighted average for differing ALC levels of shipment, averages for specific bases of from 1.5 to 1.7 days (maximum) and from 0.7 to 0.9 days (minimum), were obtained.

Using the average transit time for TP-1 (including MICAP) shipments from Table 1, the FY 1978 LOGAIR system averaged 3.2 days for shipments from ALCs. By comparison, the Mk 2 system offers a reduction of at least 1.5 days (47 percent) and the possibility of transit times reduced by as much as 2.3 days (72 percent).

The significance of reduced transit, and thus pipeline, time, has been addressed in a number of ways. In a 1977 briefing, AFLC indicated that inventory requirements for investment items in the Air Force would increase by $39 million for every day that LOGAIR transit time increased (9:52). In subsequent AFLC briefings, options for variable pipeline times for investment items for selected weapons systems overseas were said to require investments of from $45 million to $113 million based on incremental adjustment of transit time (12:26). Even the US Navy, in its typically unique way of looking at this subject has stated (in reference to the QUICKTRANS contract airlift system) that"$1.00 per year of QUICKTRANS avoids pipeline investment value of $4.20" (17:10).

The essence of high speed transportation is to reduce the total investment in items that would otherwise be tied up in transit or in base and depot stock levels (8:9).

The effects of reduced transit time can be either a reduction in the amount of investment for spares or the freeing of funds for further investment in other critically short items or in some combination of both. It is important to note that the bulk of any inventory savings realized as a result of reductions in the pipeline, are one-time savings that are usually "purchased" with increased transportation costs (8:10).

While there is little doubt that a reduction of even one day on the average throughout the entire Air Force supply system would have a dramatic effect, the more difficult impact to assess is the effect on readiness. Obviously, the capability to have overnight service to any base in the CONUS would appeal to Wing Commanders with a MICAP problem,

Table 5.
Comparison of Annual Statistics

	LOGAIR Mk 2	LOGAIR FY 78
Number of Online Stations Served	58	60
Total Miles Scheduled	15,193,125	13,396,230
Total Landings Scheduled	30,660	33,945
Total Ton-Miles Available	287,380,553	232,538,452
Total Ton-Miles Flown	233,508,231	148,642,470
Ton-Mile Utilization	81.3%	63.9%
Cost Per Available Ton-Mile (cents)	20.64	21.04
Cost Per Ton-Mile Flown (cents)	25.40	32.94
Total Cost (Millions of Dollars)	59.3	49.90

but the resulting improvement in readiness posture is difficult to measure and almost impossible to validate in dollar terms.

Possible Applications

At the present time, the single hub concept could conceivably be applied in the CONUS or overseas. In the CONUS, a Mk 2 LOGAIR system would provide a much needed overnight support capability for MICAP shipments as well as significantly reducing the pipeline time for repair cycle assets. The advancing age of many CONUS weapons systems would seem to place increasing pressure on the logistics system, particularly spare parts availability. In the overseas theater, specifically Europe, the single hub concept applied to a major APOD would create a significant intra-theater airlift system. This type of system, using military aircraft, and flying short route segments would provide direct interface between the strategic airlift system and the user bases. This mini-LOGAIR system would greatly enhance the logistic support to a rapidly expanding inventory of a new aircraft in the European theater, and could operate with a minimum of aircraft and terminal capability. As a minimum, the single hub concept should be evaluated by HQ USAF as a possible future alternative to the existing LOGAIR structure and by HQ USAFE as the basis for a possible intra-theater airlift support system.

Clearly, further research is needed on the relationship between increased levels of logistics support, specifically reduced transit time, and overall force readiness.

REFERENCES

(1) Bernhart, Major James, Headquarters, Air Force Logistics Command, Wright-Patterson AFB, Ohio. Personal Interview, 2 January 1979.

(2) "Canada's Biz Jet Challenge." *Air International*, Volume 15, No. 2 (August 1978), pp. 70-71.

(3) Department of Defense Directive 4410.6. *Uniform Materiel Movement and Issue Priority System (UMMIPS)*. Washington: Department of Defense, 4 February 1974.

(4) Johnson, Baily, Federal Express Corporation, Washington, D.C. Personal Interview, 22 December 1978.

(5) Kipp, Robert. *History of the AMC Contract Airlift System (LOGAIR) 1954-55*. Wright-Patterson AFB, Ohio: Headquarters, Air Materiel Command, March 1956.

(6) Lovelock, Christopher H. "Federal Express." Case Study. Harvard Business School, December 1976.

(7) Smykay, Edward W., Bowersox, Donald J., and Mossman, Frank H. *Physical Distribution Management*. New York: The MacMillian Company, 1961.

(8) Tripp, Robert S., and McClish, Paul S. *AFLC Management Initiatives to Improve Support Readiness: An Evaluation of Transportation Alternatives* Working Note 76-9A. Wright-Patterson AFB, Ohio: Headquarters, Air Force Logistics Command, May 1977.

(9) USAF, Air Force Logistics Command. *AFLC Logistical Airlift Briefing—LOGAIR* Briefing Text. Wright-Patterson AFB, Ohio: HQ AFLC, October 1977.

(10) ______. *FY 78 LOGAIR Flight Schedules and Routing Guide*. Wright-Patterson AFB, Ohio: HQ AFLC, 1 October 1977 and changes dated 15 February 1978 and 30 April 1978.

(11) ______. *FY 79 Cargo Shipments Table* Report No. 1. Wright-Patterson AFB, Ohio: HQ AFLC, 1978.

(12) ______. *Logistics Support Alternatives* Briefing Text. Wright-Patterson AFB, Ohio: HQ AFLC, 19 January 1978.

(13) ______. *Materiel Pipeline Report* Microfiche. (RCS:LOT-DST (M) 7154) Wright-Patterson AFB, Ohio: HQ AFLC, Monthly Reports 1976-1978.

(14) ______. *Movement Report (Cargo)* Printout. Wright-Patterson AFB, Ohio: HQ AFLC, 1978. Individual reports, by base, for FY 77.

(15) U.S. Congress. House. Committee on Appropriations. *Department of Defense Appropriations for 1979. Hearings before a Subcommittee of the House Committee on Appropriations* Part 7. 95th Cong., 2d sess., 1978.

(16) U.S. Congress. House of Representatives. *Defense Appropriations Fiscal Year 1979. Conference Report No. 95-1764*. 95th Cong., 2d sess., 1978.

(17) USN, Naval Supply Systems Command. *Logistics Tradeoff Opportunities* Briefing Text. Norfolk, Virginia: Headquarters, Naval Supply Systems Command, 19 January 1978.

(18) See Elie J. Boudreaux and John B. Olansen, "The Design of LOGAIR Feeder Routes," Thesis, Air Force Institute of Technology, Wright-Patterson AFB, Ohio, June 1977; Winfied C. Frank and David L. Niese, "Department of Defense CONUS Logistics Airlift: A Comparative Analysis of Two Alternative Methods of Operation," Thesis, Air Force Institute of Technology, Wright-Patterson AFB, Ohio, August 1970; and Donald Y. Huff, Ellis J. Alexander, and Paul Woodside, "High Speed Transportation—Its Present and Future Service Under Changing Logistic Concepts," Advanced Logistics Report, Air Force Institute of Technology, Wright-Patterson AFB, Ohio, June 1961.

(19) Federal Express Corporation. "Federal Express Service Guide, 4th Quarter, 1978." Memphis, Tennessee: Federal Express Corporation, 1978.

Air Logistics Center Item of Interest

Tinker AFB as an Aerial Port of Embarkation

The Aerial Port of Embarkation (APOE) at the Oklahoma City Air Logistics Center (OC-ALC) is the only inland operation of its kind in the United States and the only APOE run by Air Force Logistics Command. The location at Tinker AFB has several advantages. First of all, Tinker can ship material both East and West, a very unique feature of this APOE. It operates five direct MAC channels to the Pacific area and three to Europe. Secondly, it can ship material not only from all bases located in the central United States, but it can handle Pacific bound items for eastern bases and Europe bound items for western bases. This practice not only saves LOGAIR expenditures, but also reduces shipment pipeline time. When the European airlift channels were first opened in July 1977, the Sacramento, San Antonio, and Ogden ALCs funneled their Europe bound material into the Tinker APOE. The average shipping time from origin to Europe was consequently reduced from an average of 13.3 days by way of Dover AFB to only 10.5 days via the Tinker route.

A third advantage is that Oklahoma City ALC managed items, including aircraft engines, can be shipped directly to virtually any place on the globe. This greatly enhances the ALC's ability to supply overseas units, both permanent and deployed (such as those on NATO missions).

The Directorate of Distribution at Tinker is currently engaged in an ambitious APOE enhancement program that began in FY 79 with the implementation of the new AFLC LOGAIR Real-Time Terminal System (0ØØ6). This computer program is helping to track and move all material handled within APOE. During FY 80, plans exist to enlarge the Air Terminal facility by 66,000 square feet and install more modern material handling equipment. This is an operation that is paying dividends to the Air Force through greatly improved support capability which, in turn, has enhanced its total readiness posture. (OC-ALC/DSMPA, Leroy Anderson, AUTOVON 735-3369.)

CURRENT RESEARCH

AIR FORCE LOGISTICS MANAGEMENT CENTER (AFLMC) LOGISTICS RESEARCH PROGRAM FOR FY 80 THROUGH FY 84

The mission of the AFLMC is to increase Air Force readiness and capability by developing, analyzing, evaluating and implementing new or improved concepts which will enhance logistics efficiency and effectiveness. Inherent in this objective is the elimination of those processes which consume resources but do not contribute to readiness. The AFLMC also serves as a coordination point for Air Force logistics studies and research, provides an in-house research capability and assists in the implementation of logistics improvements. The AFLMC focuses primarily on management science and operations research activities which will produce beneficial impacts on the Air Force logistics system. In fact, all projects remain active in phases from research through actual implementation.

The AFLMC occupies a unique position in the organizational structure of Air Force logistics. It receives direction from the Deputy Chief of Staff for Logistics and Engineering, Headquarters Air Force, and each project is reviewed by the appropriate Air Staff Director. Broad program guidance is provided by a Board of Advisors chaired by the Director of Logistics Plans and Programs, HQ USAF/LEX, and composed of other HQ USAF logistics and research functional staff directors. Membership also includes senior logisticians from Air Force Logistics Command, Military Airlift Command, Strategic Air Command, Tactical Air Command, and the Office of the Air Force Deputy Assistant Secretary for Logistics. This board exercises overall control to insure that AFLMC programs are responsive to current and long range logistics needs. The AFLMC also maintains a close working relationship with base level units and studies and research organizations in the Air Force, civilian industry, and the academic community.

At a recent Board of Advisors meeting, 12 Dec 79, the AFLMC presented its current and five year program for FY 80 through FY 84. The program was approved, and the AFLMC is committed to research in support of the program areas that follow. The commercial telephone number of the focal point personnel is (Area Code 205) 279-plus the last four digits of the AUTOVON number.

TITLE: **Capability Assessment**

OBJECTIVE: Identify and review techniques, methods and models which can be used to assess the capability of specific logistics resources to support operational missions. Attention will be focused on techniques which translate information on logistics resource levels into sortie generation capability. The various methods will be evaluated in terms of criteria derived from requirements for a readiness reporting system, the annual mission area analysis process, and the planning, programming and budgeting system.
FOCAL POINT: Maj Nolte, AFLMC/LGY, AV 921-4524.

TITLE: **Reliability Centered Maintenance**

OBJECTIVE: To ascertain the impact of weapon system reliability on logistics support requirements and performance and to use reliability measures to predict and influence logistics performance and policy. Changes in weapon system reliability characteristics can significantly affect spare part inventory demands, maintenance, inventory transportation requirements, spare parts procurements and most importantly, fleet performance. Research will be conducted to find a sound, practical, and acceptable theory which will provide the best interval between periodic inspections. Attempts will be made to isolate a relationship between operational activity (as a leading indicator) and logistics requirements. That is, it may be possible to accurately predict the increase in requirements, given an increase in the number of sorties.
FOCAL POINT: Lt Roncallo, AFLMC/LGY, AV 921-4524.

TITLE: **Source Data Automation (SDA) Evaluation**

OBJECTIVE: To provide a test bed computer facility that will be used to investigate SDA technology and demonstrate those SDA techniques best suited for exploitation within the Air Force logistics community. The handling of data at base level is manpower intensive. Source data automation can help to alleviate this situation. The cost of errors and the impact of delays in data entry could have a significant impact upon logistics operations and mission effectiveness. There are many areas within logistics where source data automation could be used; the problem is to identify those applications which are feasible - technically and practically. Also, this program will: examine alternative means of automated marking and reading symbols; determine the symbology and data elements to be encoded on items of supply, unit packs, and outer containers; improve productivity, timeliness, and accuracy in the distribution of DOD supplies; and reduce the burden of paper work and related costs within logistics operations.
FOCAL POINT: Maj Morgan, AFLMC/LGY, AV 921-4524

TITLE: **Theater Distribution**

OBJECTIVE: To define and evaluate alternatives to current supply systems for handling resupply and lateral supply actions in a theater of operation, particularly during a contingency. The Defense Resource Management Study identified a theater distribution system (TDS) as a concept which displayed the potential to strengthen the logistics posture of theater forces. To further define and develop the TDS concept, HQ USAF/LEX tasked the Rand Corporation to study possible alterations in the current transportation system and tasked the AFLMC to evaluate alternatives in the current supply system with and without changes in the transportation system. AFLMC study efforts will be directed toward analyzing the basic TDS concept and determining the relative impact of various supply policies through analytic and simulation modeling. Part of this work will include identifying the characteristics of supporting transportation and information networks. An equally important area of study will be an assessment of the impact of implementing a TDS.
FOCAL POINT: Dr. Gage, AFLMC/LGY, AV 921-4524

TITLE: **Technical Data**

OBJECTIVE: To perform in-depth reviews of Technical Order (TO) requirements, military specifications and management. Efforts are already underway to evaluate the potential for centralized

management of TOs. Other specific opportunities exist in TO acquisition management including the verification/ validation processes and in reducing the lag between the time basic changes to TOs are required for equipment modifications and the time they are actually published. State-of-the-art techniques will be sought to improve management, streamline TO production processes and reduce costs.
FOCAL POINT: Lt Col Worthington, AFLMC/LGM, AV 921-4581.

TITLE: **Maintenance Training**

OBJECTIVE: To provide an improved maintenance training program which will enable the Air Force to maintain a highly trained cadre of maintenance specialists in spite of increasingly complex weapons systems, decreasing mechanical aptitudes of recruits, and changing organizational structures. The AFLMC will become a clearing house for training projects and will establish a Maintenance Training Improvement Program (MTIP), chaired by HQ USAF. Symposiums and conferences will be conducted, and action items will be monitored until completion.
FOCAL POINT: Maj Townsend, AFLMC/LGM, AV 921-4581.

TITLE: **Maintenance Management Processes**

OBJECTIVE: To increase the maintenance management capability to provide the proper amounts of resources at the proper place, at the proper time. Accomplish this by eliminating redundant systems and improving the gathering of information and use of data. Particular emphasis will be given to developing effective resource allocation methods and to providing an organizational structure which matches maintenance requirements. Possible uses of simulation models and source data automation techniques will be explored.
FOCAL POINT: Maj Dietsch, AFLMC/LGM, AV 921-4581.

TITLE: **Transportation Management Information System**

OBJECTIVE: To develop a management information system for the Traffic Management Office (TMO). The system may be manual or utilize data automation equipment and will be designed specifically for division/branch chiefs and transportation commanders, enabling them to not only assess performance but evaluate future potential relating to mobility/contingency situations.
FOCAL POINT: Capt Barrett, AFLMC/LGT, AV 921-4464.

TITLE: **Transportation Automation Requirements**

OBJECTIVE: As a spin off from the previous project, to investigate the use of automated systems within TMO. While management personnel need a responsive data source for evaluation and planning purposes, automated systems offer great potential for workers to improve efficiency and reduce operating costs.
FOCAL POINT: AFLMC/LGT, AV 921-4464.

TITLE: **Combat Support Transportation**

OBJECTIVE: To enhance logistic studies by active transportation participation in initial phases of planning. New systems studies such as the Theater Distribution System envisioned for Europe will be such an effort involving transportation expertise from the outset. Subsequently, greater AFLMC involvement in transportation activities of the overseas commands is appropriate especially as it relates to evaluation and implementation of new systems.
FOCAL POINT: Lt Col Hargett, AFLMC/LGT, AV 921-4464.

TITLE: **Stockage Policies**

OBJECTIVE: Improve the policies and procedures whereby the Air Force manages its inventory of spare parts, equipment and supplies. This includes ensuring an appropriate range and depth of goods are available so combat readiness can be maintained or improved at minimal cost. Specific opportunities for improvement exist in the areas of refining the definition of supply readiness, developing better indicators to assess capability in terms of available inventory, and maintaining visibility of the effectiveness of retail stockage policies.
FOCAL POINT: Maj Lombardi, AFLMC/LGS, AV 921-4165.

TITLE: **Performance Analysis**

OBJECTIVE: To identify measures of supply performance that have a statistically significant correlation with measures of operational capability. Preliminary work has shown that traditional supply measures such as Not Mission Capable Supply (NMCS), Stockage Effectiveness, etc., have not displayed any such statistical correlation. Indicators providing a more meaningful method of evaluating inventory policies and procedures require development. This study will address an evaluation of all existing scientific and technical information to determine what cause-effect relationships have been established between inventory support and operational functions.
FOCAL POINT: Maj Lombardi, AFLMC/LGS, AV 921-4165.

TITLE: **System Support Contracting**

OBJECTIVE: To explore the role of contracting in supporting major weapon systems at base level. Specific areas the AFLMC will concentrate on are: developing new training programs for personnel who will be supporting major systems; determining manning requirements for supporting systems; and identifying means of facilitating inputs from base contracting in the development of new systems.
FOCAL POINT: Maj Hudson, AFLMC/LGC, AV 921-4085.

TITLE: **Base Support Contracting**

OBJECTIVE: To improve the efficiency and responsiveness of the base contracting office by expanding sources of supply; working with the Small Business Administration and trade associations; developing a method for improving requirements generation at base level that will allow customer activities to improve Statements of Work (SOW); providing guidelines for price and cost analysis at base level; developing more cost effective ways of administering construction contracts; and establishing a comprehensive training program at base level to train more people in place rather than send them to schools.
FOCAL POINT: Maj Hudson, AFLMC/LGC, AV 921-4085.

TITLE: **Wartime Support Contracting**

OBJECTIVE: To enhance contracting support of wartime scenarios. The AFLMC will concentrate on improving operations plans for contracting aimed at becoming more responsive to emergency requests and on developing a plan for awarding blanket purchase agreements with overseas vendors for use in a wartime scenario.
FOCAL POINT: Maj Hudson, AFLMC/LGC, AV 921-4085.

TITLE: **Contingency Planning**

OBJECTIVE: To continue the AFLMC role as the user representative for development of the logistics portion of the Air Force standard automated planning system known as the Contingency Operation/Mobility Planning and Execution System (COMPES). The AFLMC will also analyze the requirement, costs and benefits of an on-line system at base level to support the mobility management mission. At the MAJCOMs there is a need to perform feasibility analysis in terms of operational needs, unit tasking, and support capability. There is an additional requirement to analyze unit capabilities by Unit Type Code in terms of asset availability.
FOCAL POINT: Lt Col Baergen, AFLMC/LGX, AV 921-3535.

TITLE: **Logistics Planning Factors**

OBJECTIVE: To improve the management and validity of some logistics planning factors. Initial efforts will be to work with the MAJCOMs and the Air Staff to develop an approach for computing WRM ground petroleum requirements and to identify improved methods for developing and updating the logistics planning factors used in the Joint Operation Planning System (JOPS) for computing resupply requirements.
FOCAL POINT: Maj Froehlich, AFLMC/LGX, AV 921-3535.

TITLE: **War Reserve Materiel Program Management**

OBJECTIVE: To provide a single information document that concisely defines WRM management. The current role of the AFLMC is to develop a compendium describing the WRM process. The compendium will contain a systematic classification of the interrelationships of WRM functional management, documentation, and software systems. The knowledge gained from this initial effort will be used to identify WRM management problems and recommend improvements.
FOCAL POINT: Maj Osborne, AFLMC/LGX, AV 921-3535.

TITLE: **Wartime Logistics Command and Control**

OBJECTIVE: To research, document and analyze any deficiencies in the current system. The long term effort will include development of alternative solutions to improve logistics command and control during wartime. This study will consider intra-theater transportation, host nation support, collocated operating bases, and resource reporting and redistribution in a dynamic environment. There is a strong link between this effort and other studies such as the Theater Distribution System (TDS) study.
FOCAL POINT: Maj Johnson, AFLMC/LGX, AV 921-3535.

TITLE: **Establish an Air Force Logistics Plans Advisory Group**

OBJECTIVE: To provide a more structured, standard way to improve the coordination of logistics plans and improvement efforts. This group should be formed with an official charter. The Logistics Plans Advisory Group should improve communications between and among commands on significant issues or developments in contingency planning and readiness, and should eliminate unwarranted redundancy in readiness initiatives.
FOCAL POINT: Lt Col Baergen, AFLMC/LGX, AV 921-3535.

TITLE: **Long Range Logistics Impacts**

OBJECTIVE: To perform a literature review to determine the availability of information and applicability of current studies that project the Air Force environment through the year 2000 and upon completion of the literature review assess the impact of the environment on the logistics system. Logistics Long Range Planning is receiving increased emphasis in the U.S. Air Force. The planning process has as its foundation an understanding and appreciation of the future environment and its impact on the logistics system. Findings from the study will be incorporated into a Logistics Long Range Planning Guide - Part II; presented to the Logistics Long Range Planning Seminar; and used to interface with the preparation of the Air Force Global Assessment and Guidance Memorandum.
FOCAL POINT: Maj Johnson, AFLMC/LGX, AV 921-3535.

TITLE: **Future Logistics Management Needs**

OBJECTIVE: To evaluate and determine what organizational structure can best serve future Air Force logistics needs. Significant factors exist which indicate changes may be required in the way the Air Force conducts its future functions. Cost of equipment, spares, labor, facilities, fuel and other materiels, increasing equipment complexity, and a critical need for more combat capability and flexibility are leading toward increased centralization of repair facilities and greater reliance upon transportation, communications, and computers. Our traditional three level maintenance concept, standard base supply systems, and transportation management may require major changes and even complete reorganization to support future logistics requirements. The study will examine current logistics practices in the Air Force and develop alternative organizational structures which can best serve the needs of the Air Force over the next twenty years.
FOCAL POINT: Maj Johnson, AFLMC/LGX, AV 921-3535.

Each of the above research areas represents in typical fashion several sub-projects and many man-years of effort. To complete its programs in the desired time frames, the AFLMC will augment its personnel with external resources. Augmentation is being obtained primarily by contract; however, other options available through faculty and student research programs, temporary hire, or the Air Force Reserves are being exploited, and the emphasis on this type of augmentation is continually increasing.

In summary, the AFLMC is charted to be a focal point for the AF logistics community in improving efficiency and increasing logistics capability. The Center plays a vital role in the development of Air Force logistics improvements through coordination of multi-functional projects, elimination of redundant activities, analysis of existing methods, identification of potential improvements, and implementation of worthwhile changes to the logistics system. It will continue to serve the logistics community in solving near term problems while developing the capability to provide and formulate long range logistics goals. A close association with the Air Staff, other research agencies, and the major commands will assist in achieving a fully coordinated logistics research and development program capable of providing worthwhile improvements for Air Force logistics operations.

Delphi Survey continued from page 24

organizational unit.

5. Communicate Delphi activities and recommendations to *all* personnel.

6. Report directly to the Director.

Summary and Conclusions

Among the more than eighty solutions proposed, the following have been successfully instituted:

—Establish a group composed of representatives from each functional area to clarify a commitment to common goals based on Delphi suggestions.

—Communicate goals to all employees.

—Expand the job enrichment program.

—Work on improving the Tinker ALC image across the Air Force and local area.

—Overcome negative attitudes by positive communications.

—Improve and increase technical training.

—Reduce administrative workload on supervisors to a minimum to allow them to concentrate on production problems.

—Establish a training class for all supervisors on development or changing of personnel.

—Initiate oral, written and listening skills communications training for all first line supervisors.

The Delphi Task Force, along with the regular management control system, was used to implement the above solutions. Some of these areas are still developing, as this article is being read. The major success was determined to be an increase in the cooperative team spirit of managers who heretofore infrequently exchanged ideas and suggestions.

The Delphi survey makes an ideal research instrument to gain insight into prioritizing organizational problems. It also can be used in conjunction with a management training seminar to bridge the gap between training concepts and practical application. The Delphi Task Force Committee then continues the momentum created by the seminar, and becomes a participative management tool to put in practice ideas from the seminar.

References

(1) Folk, Michael, "Critique of Some Future Prediction Techniques and Their Implications for Education Planning," *Educational Planning*, Vol. 2-3, January 1976, pp. 35-52.

(2) Sachman, Harold, *Delphi Critique*. Lexington, Massachusetts: Lexington Books, 1975.

(3) Weaver, W. T., "The Delphi Forecasting Method," *Phi Delta Kappan*, January 1971.

Information for Contributors

General. The *Air Force Journal of Logistics* is dedicated to the open examination of all aspects of issues, problems, and ideas of concern to the Air Force logistics community. Constructive criticism of logistics as it exists today is encouraged if it is issue oriented, rationally expressed and indicates the positive action necessary for future improvement. Contributions are welcome from any source inside and outside the Air Force.

Scope. The *AFJL* will consider for publication articles and research results that add to the understanding or improvement of any aspect of Air Force logistics from maintenance, supply, transportation, and logistics plans, to engineering and services, munitions, and contracting and acquisition; from base-level and operational units to depot-level and military and civilian industrial and production logistics; from logistics civilian, enlisted and officer personnel and manpower requirements to training and education; from internal organizational structure, policies and procedures to external relations with other services, government agencies, civilian industry and allies; from daily mission support challenges to the logistics aspects of national security objectives and Air Force strategy, doctrine and tactics.

Special Interest. Articles are especially invited that:

- give the results of the application of sound analytical and research techniques to existing Air Force logistics operations;
- offer possible alternatives to current operations based on a logical assessment of today's posture and tomorrow's requirements;
- demonstrate the interrelation of various parts of Air Force logistics systems internally and with non-USAF systems;
- consider basic Air Force logistics functions and issues from an unusual perspective;
- focus on logistics and Air Force mission accomplishment;
- or, provide insight into the reasons for and impact of recent or future changes in Air Force logistics.

Original Material and Revisions. Submitted articles are received with the understanding that:

1. They have not been published nor are being considered for publication elsewhere. Articles based on research planned for publication *only* as an in-house report or in symposium proceedings are acceptable.

2. Those articles with multiple authors have been approved by all. The *AFJL* will work with the lead author in preparing the manuscript for publication with the understanding that any approved changes are acceptable to all.

3. To the greatest extent possible, necessary revisions in the manuscript will be coordinated with the author.

Length. In general, manuscripts should be between 2000-3500 words. Shorter and longer papers may be published on an exceptional basis. Formal research papers should briefly recognize the most significant research accomplished in the area of investigation and the relation of that research to the work addressed in the paper. A 50-75 word abstract should accompany each manuscript.

Format. Manuscripts should be typed with one inch margins, double-spaced on one side of standard size bond paper. References should be numbered and double-spaced on a separate page(s) at the end of the manuscript. The double number system for identifying references within the article should be used, i.e., (7:15), with the first number identifying the number of the source in the reference list and the second number indicating the specific page number in that source. When possible, potential textual footnote material should be incorporated in the main body of the article. Do not include a separate bibliography.

Figures and Tables. Supporting figures, if any, should be numbered consecutively and prepared on separate pages, one to a page. The text should clearly indicate where each figure is to appear. Tables should be numbered consecutively and be prepared within the appropriate text of the manuscript.

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"Supply and transport stand or fall together; history depends on both."

(*Winston Churchill,* The River War, *1899*)

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